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METALLURGIST

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IN ENGLISH TRANSLATION

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SIGNIFICANCE OF ABBREVIATIONS MOST FREQUENTLY ENCOUNTERED IN SOVIET PERIODICALS

FIAN	Phys. Inst. Acad. Sci. USSR.
GDI	Water Power Inst.
GITI	State Sci.-Tech. Press
GITTL	State Tech. and Theor. Lit. Press
GONTI	State United Sci.-Tech. Press
Gosenergoizdat	State Power Press
Goskhimizdat	State Chem. Press
GOST	All-Union State Standard
GTTI	State Tech. and Theor. Lit. Press
IL	Foreign Lit. Press
ISN (Izd. Sov. Nauk)	Soviet Science Press
Izd. AN SSSR	Acad. Sci. USSR Press
Izd. MGU	Moscow State Univ. Press
LEIIZhT	Leningrad Power Inst. of Railroad Engineering
LET	Leningrad Elec. Engr. School
LETI	Leningrad Electrotechnical Inst.
LETIIZhT	Leningrad Electrical Engineering Research Inst. of Railroad Engr.
Mashgiz	State Sci.-Tech. Press for Machine Construction Lit.
MEP	Ministry of Electrical Industry
MES	Ministry of Electrical Power Plants
MESEP	Ministry of Electrical Power Plants and the Electrical Industry
MGU	Moscow State Univ.
MKhTI	Moscow Inst. Chem. Tech.
MOPI	Moscow Regional Pedagogical Inst.
MSP	Ministry of Industrial Construction
NII ZVUKSZAPIOI	Scientific Research Inst. of Sound Recording
NIKFI	Sci. Inst. of Modern Motion Picture Photography
ONTI	United Sci.-Tech. Press
OTI	Division of Technical Information
OTN	Div. Tech. Sci.
Stroiizdat	Construction Press
TOE	Association of Power Engineers
TsKTI	Central Research Inst. for Boilers and Turbines
TsNIEL	Central Scientific Research Elec. Engr. Lab.
TsNIEL-MES	Central Scientific Research Elec. Engr. Lab.—Ministry of Electric Power Plants
TsVTI	Central Office of Economic Information
UF	Ural Branch
VIESKh	All-Union Inst. of Rural Elec. Power Stations
VNIIM	All-Union Scientific Research Inst. of Meteorology
VNIIZhDT	All-Union Scientific Research Inst. of Railroad Engineering
VTI	All-Union Thermotech. Inst.
VZEI	All-Union Power Correspondence Inst.

Note: Abbreviations not on this list and not explained in the translation have been transliterated, no further information about their significance being available to us. — Publisher.

FERROUS METALLURGY IN THE YEARS OF SOVIET POWER

Tsarist Russia held fifth place in the world for the production of iron, steel and rolled products. Production of pig iron in 1913 was 4,200,000 tons, steel production 4,230,000 tons and output of rolled products 3,500,000 tons.

The first world war and the civil war and the economic ruin caused by them led to a decline of ferrous metallurgy. In 1920, only 100,000 tons of pig iron, 162,000 tons of steel and 147,000 tons of rolled products were produced.

The Soviet people were confronted with the problem of restoring and lifting up the whole of industry and especially ferrous metallurgy – the basis of the entire national economy. This problem was successfully solved by the heroic labor of the people. By 1928, the production of ferrous metals had already reached the 1913 level in the Soviet Union.

During the first two Five-Year Plans, new metallurgical giants were built, the production of quality metals was mastered and the output of steel tubes was increased by many times. As a result of successfully fulfilling the first Five-Year Plans, the Soviet Union won second place in the world in 1937 for the production of ferrous metals.

In five years, following the victorious conclusion of the second world war, Soviet metallurgists successfully completed the restoration, on a new technical basis, of the destroyed metallurgical plants and, by 1950 had attained the prewar level of metal production.

During the fifth Five-Year Plan, ferrous metallurgy grew apace. In 1956, the first year of the sixth Five-Year Plan, 35,800,000 tons of pig iron, 48,600,000 tons of steel and 37,800,000 tons of rolled products were produced.

As a result of the unbending policy of the Party and Government as regards the future growth of all branches of national economy based on the preferred development of heavy industry, the production of pig iron in the U.S.S.R. compared with the 1913 level, increased by 800%, steel production by 1100% and the output of rolled products by 1000%. Not a single world state has known such rates of development.

This progress, possible only in a socialist country, was a result of the tireless and inspired labor of Soviet metallurgists directed by the great Communist Party of the Soviet Union which led our country out of poverty and ruin and transformed it into a powerful industrial state.

A low technical level and the predominance of labor-consuming manual operations on furnace charging and on removal of product were characteristic features of the blast-furnace industry in Tsarist Russia. After the war ended and the interventionists had been driven away, a speedy restoration of the metallurgical industry began. Nearly all major blast-furnace plants of pre-revolutionary Russia were put into operation. At the same time the construction of new, more powerful and technically advanced blast furnaces took place. At the Dzerzhinsk Works, under the supervision of I. P. Bardin, blast furnaces with a working volume of more than 500 cu m were erected.

In 1926 the State Institute for Metallurgical Works Design (Gipromez), which played a great part in the development of the home metallurgical industry, began functioning.

In 1929 pig iron production in the USSR exceeded the level of the pre-war output of 1913.

The construction of a number of new metallurgical works— Magnitogorsk, Kuznetsk, "Zaporozhstal" and "Azovstal" – as well as a radical modernization of old works – Dzerzhinsk, Voroshilov, Makeyevsk and others – was begun in the first Five-Year Plan. New blast-furnace plants, quite distinct from the old ones in their rational design, high capacity units and modern equipment, were erected. The first blast furnace of 842 cu m volume with mechanized charging of raw materials fully designed by Soviet engineers, was blown in at the Makeyevsk Works in 1929. New air blowing machines, mechanization of labor-consuming operations and the reorganization of internal works transport promoted a better utilization of units and an increase in the output of pig iron in the country.

The Magnitogorsk and Kuznetsk Combines and the "Zaporozhstal" Works were put into operation towards the end of the first Five-Year Plan (1932).

A blast furnace of 930 cu m volume constructed according to the standard design prepared by Gipromez was blown in at the Dzerzhinsk Works, and then similar furnaces were erected at the Voroshilov, "Azovstal" and other metallurgical works.

The construction of new, and the modernization of old, blast-furnace plants was continued during the second and the third Five-Year Plans. Blast furnaces were built in the following works; Novo-Tagil, Novo-Lipetsk, Novo-Tula, Krivorog. A second standard blast furnace of 1300 cu m working volume, at that time the largest blast furnace in the world according to the working volume and the output, was designed by Gipromez. Furnaces of this type were built at the "Zaporozhstal," the "Azovstal," and the Krivorog Works.

The pig iron output reached 14,900,000 tons in 1940, with 94 blast furnaces in operation at the end of that year; 32 blast furnaces out of this number being of about 1000 or more cu m in volume. The mean blast-furnace volume increased correspondingly. While in 1913 it was 190 cu m and in 1927 290 cu m, in 1940 the mean volume constituted 606 cu m.

A rise in the qualifications of the personnel and the improvement of working conditions were conducive to better utilization of blast-furnace working volume.

Year	1913	1930	1935	1940
u.c.w.v. (utilization coefficient of working volume)	2.30	1.69	1.35	1.19

Explored reserves of raw materials for ferrous metallurgy were increasing simultaneously with the development of the blast furnace industry. The iron ore reserves in the Krivorog, Magnitogorsk, Goroblahodat, Vysokogora and other deposits were ascertained and increased considerably. During the years of Soviet rule new deposits of iron ore were discovered in Gorna Shoriya, Orsko-Khalilovskoe, Kola peninsula (Olenegorskoe and Enskoe) in the region of the Kursk magnetic anomaly, and other places. The USSR became the country with the largest iron ore reserves in the world.

The mining of coking coal increased. The Kuznetsk and the Karaganda coal fields were put into operation and coke production was increased.

At that time, however, iron ore was not yet properly prepared for blast-furnace smelting. Ore preparation for smelting was limited only to crushing, and concentration and sintering were hardly developed. Only 6,000,000 tons of sintered agglomerate were produced in the whole of the USSR in 1940.

The treacherous aggression of Hitlerites on the USSR checked the growth of the Soviet Metallurgical industry. All the southern works were put out of action. The number of operating blast furnaces in the USSR decreased to 35. The blast-furnace operators in the Urals and Siberia helped the front by their selfless labor. Under the difficult war conditions, when the rich manganese ores could not be delivered to the Urals, the "Magnitka" * blast furnace workers organized the production of ferromanganese from poor manganese ores from the Urals and Kazakhstan.

Constructors and blast-furnace workers had several successes in building and putting into operation the blast-furnace plant at the Chelyabinsk Works, No. 2 blast furnace at the Chusovsk Works, No. 3 blast furnace at the Novo-Tagil Works, and others. Small furnaces, which had been out of action for a long time in the Urals at the Staro-Utkin and Verkhne-Ufaleisk Works, were reconditioned.

After the invaders were driven out of the Ukraine, the reconstruction of the southern metallurgical industry began. An enormous task had to be faced: the blast furnaces had been demolished and the equipment dismantled. Soviet constructors and fitters accomplished the difficult task of restoring the blast furnace plants in the shortest time possible.

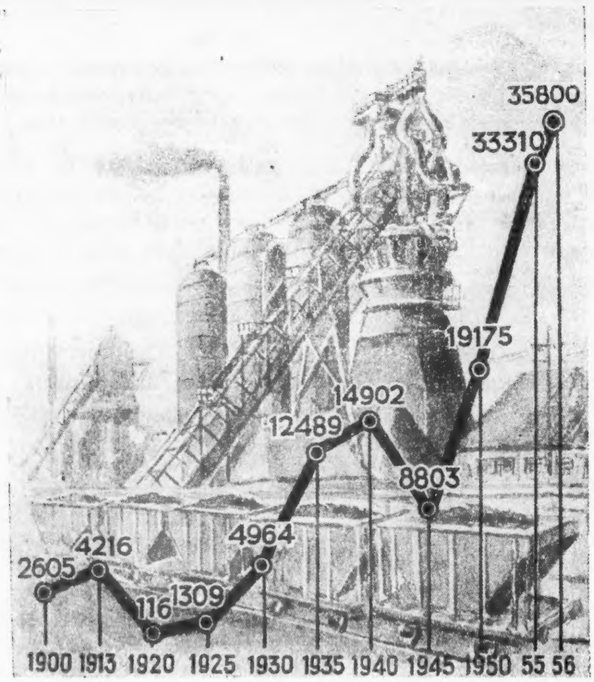
The rebuilding of the demolished blast furnaces was combined with their modernization. New equipment was set up everywhere and in several cases the furnace volume was increased. Near the beginning of the fifth Five-Year Plan (1951 – 1955), blast furnace reconstruction was completed. The pig iron output constituted 19,200,000 tons in 1950, and the utilization coefficient of the working volume was 0.98. At the end of 1950 there were 90 blast furnaces operating in the USSR, their total volume exceeding the prewar one.

The construction of new plants continued in the subsequent years; in the period from 1951 to 1956, new blast furnaces were erected at the Cherepovets and Zakavkaz Works and at the Orsko-Khalilovsk Metallurgical Combine. New furnaces of 1300 – 1386 cu m working volume were put into operation at several plants (the Magnitogorsk Combine, the Dzerzhinsk Works, the Novo-Tagil Works, the Chelyabinsk Works, and others). In the same period the design of blast furnaces of 1513 and 1719 cu m was developed, and the design of a blast furnace of 2286 cu m volume was undertaken. At the same time unprofitable iron making at the plants – Chernokholunitsk, Maikor, Verkhne-Ufaleisk and Nizhne-Serhinsk – was terminated. As a result of these measures the mean working volume of the blast furnace in the USSR at the present time has reached 800 cu m.

However, the characteristic feature of the period 1951 – 1956 is not so much the rise in the number of blast furnaces and the increase of their volume as the substantial changes in the technology of pig iron production, which marked a turning point in the blast furnace industry and made possible a rapid increase of pig iron output in the country. The result of these radical changes was an enormous improvement in the operating efficiency of blast furnaces: the utilization coefficient of working volume increased by 25% (from 0.98 – 0.78) in the period 1950 – 1956.

The new technology consisted, first of all in a considerable improvement in the preparation of ore for the blast furnace process. This improvement was reflected in the development of methods for substantial iron ore beneficiation, in the observation of the uniformity of ore at advanced works in all the stages from the mine to the blast furnace, and in the improvement of ore crushing and grading. Agglomerating of iron ore was rapidly developing: on January 1, 1951, there were, in the USSR, 26 agglomerating machines with a total area of 1247 sq m, whereas on January 1, 1957, there were already 64 machines and their total area constituted 3297 sq m. The production of the agglomerate increased correspondingly from 12 to 40 million tons, and its amount in the charge of blast furnaces (on the average in the USSR) increased from 42% to 66%. It had previously been considered that the agglomerate should not exceed 60 – 70% in the charge of the blast furnace. Experience showed

* Another name for Magnitogorsk.



Growth of pig iron output in blast furnace plants of the USSR (in thousands of tons).

that raising the amount of agglomerate in the charge up to 100% considerably increases the efficiency of the furnace and reduces coke consumption.

A very important contribution to the increase of pig iron output was made by the introduction for the first time at the Magnitogorsk Combine of the production and application of fluxed agglomerate. While in 1950, in all, 1.8 million tons of fluxed agglomerate was sintered, its production in 1956 reached 35 million tons and constituted 87.9% of the total agglomerate production in the USSR. The application of fluxed agglomerate made possible a sharp reduction in coke consumption and an increase in blast-furnace efficiency. Practical experience showed that, on replacing ordinary agglomerate with the fluxed one of basicity 1.25, the furnace output increases by up to 12%; the coke consumption is reduced by the same amount.

A very important innovation in blast-furnace technology was the change to the operation of blast furnaces at an increased gas pressure, first effected at the Magnitogorsk Metallurgical Combine. At present 53 blast furnaces are operated by this method; the gas pressure of 0.8 – 0.9 atm is fully mastered. An important task is a further increase in pressure to 1.1 – 1.5 atm. The pioneers in this work were the Ilyich Works (Zhdanov) where a blast furnace is operated at 1.3 atm gas pressure and the Cherepovets Metallurgical Works where gas pressure was raised to 1.4 atm. It is necessary for all the blast furnaces equipped for the operation at 1.5 atm gas pressure to master the operation under such conditions in the very near future.

The adoption of the constant humidity blast with 15 – 25 g of moisture per cu m was also of importance. This improvement, first applied in the blast-furnace industry at the Kuznetsk Combine, allowed a steady and highly efficient operation of blast furnaces at a considerably increased blast temperature. At present there are 96 blast furnaces operating with constant humidity blast. In the majority of works the blast temperature increased from 650 – 750 deg C to 850 deg C and higher. In this connection shielded nozzles, first adopted in the furnaces of the Magnitogorsk Combine, should be generally introduced.

In recent years the production of low manganese pig iron has begun to be practiced on a large scale. A partial or complete elimination of manganese ore from the charge considerably improves the operation of

the furnace and reduces limestone consumption, and an increase of magnesium oxide content in the slag ensures the formation of stable slags. Prolonged experience of several plants confirmed a great economic advantage in low manganese pig iron production.

Improvements introduced into the blast-furnace industry are not limited to the above instances. The adoption of oxygen enriched blast, the automation of charging and of blast operation in the blast furnaces, a complex automation of blast-furnace operation control, and other innovations will allow a considerable increase in pig iron output and a cut in pig iron cost. Unquestionably, however, the main reason for the improvement in the operating efficiency of the blast furnaces was an extraordinarily rapid advancement of the technical level of personnel, possible only under socialist conditions.

The time when the evaluation of the charge was the "secret" of the head of the plant and the charge log book was under lock and key belongs to the past; those not-so-far-gone times when any, even the slightest, change in furnace operation required permission from the head of the plant and when the foreman was occupied mainly with the preparation and carrying out of metal tapping and slag removal are also becoming the story of the past. Nowadays the foreman is in full control of the furnace in his shift.

The skill of blast-furnace operators and their high qualifications did not appear overnight, but as a result of vast collective experience accumulated in the course of large volume blast furnace operation. It is, first of all, the result of extensive work carried out by the Kuznetsk and Magnitogorsk blast-furnace personnel on the development of methods for the control of gas stream, the distribution of charge materials and the control of furnace operation "from above." At the present time most of the blast furnace foremen, engineers, technicians and operators of the Soviet Union widely and deliberately apply these methods, which ensure optimum results. An example for all the blast furnace workers of the USSR is provided by the smooth and well-coordinated blast furnace operation at the Magnitogorsk Metallurgical Combine. Last year foremen Kolduzov, Ryabtsev and Khabarov obtained excellent results; they achieved a mean 24-hrs pig iron output of more than 2300 tons in some months. They work as one man, i.e.; apply the same methods in the furnace operation. This working principle is now applied also in other plants where previously each foreman had his own style and his own methods, which had a negative effect on the blast-furnace operation.

The achievements of the outstanding blast-furnace operators do not remain secret; their experience is passed on to the workers at other plants, inter-plant schools; technical periodicals and the publication of informational bulletins on individual works are of great assistance in the dissemination.

A great deal has been accomplished by the Soviet blast furnace workers, but even more still has to be done. The improvement of the blast-furnace operation becomes more and more difficult; it is easier to lower the utilization coefficient of working volume from 1.1 to 0.9 than, for instance, from 0.70 to 0.65. However, not all the potentialities of the blast-furnace industry are fully exhausted. The extent of agglomerate fluxing at Southern works is still inadequate (0.9 – 1.0). For an increased basicity it is necessary to increase the capacity of the agglomerating equipment, to attain the size of limestone and coke fines of 0 – 1 mm, and generally to adopt the addition of quicklime to the agglomerate charge. The agglomerate from mine beneficiation plants should be delivered to the blast furnace plants either hot, in special railroad cars, or cooled with air, in coolers, prior to loading. The practice of low manganese pig iron production should be extended in the southern plants.

The blast furnace personnel is faced with the task of intensifying the sintering process, of the production and application of sinter. It is necessary to carry on the work on further increased intensification of the blast furnace process and the reduction of coke consumption; to develop methods of inexpensive and highly efficient sulfur and silicon removal from pig iron inside the furnace; to establish automation methods for the control of blast furnace operation. There is no doubt that these problems will be solved by the combined efforts of manufacturers and scientists.

Soviet blast-furnace workers will strive to increase pig iron production and strengthen the industrial power of our country.

OPEN HEARTH PRODUCTION

Open hearth shops in Tsarist Russia were distinguished by their small capacity furnaces (the biggest were of 65 to 70 tons capacity), low crane capacity and lack of mechanization of processes involving heavy labor. Shops of the European type were designed for low productivity. All the basic operations of the technological process (preparation and charging, preparation of casting assemblies, etc.) were concentrated in a single building. Steel was usually produced in small ingots. Open hearth furnaces with low productivity operated on producer gas with low heat inputs.

In 1922 to 1923, a start was made with the restoration and reconstruction of metallurgical plants. During this restoration, the capacity of open hearth furnaces was increased up to 70 to 80 tons; in order to raise the heat input of the furnace, firing with a mixture of coke oven and blast furnace gas was introduced. To improve the life of the refractory lining of the furnace and reduce down time for furnace repairs, crown roofs were installed and back walls began to be sloped.

As a result of such redesign, furnace productivity was rapidly increased.

However, the level of steel production attained could not satisfy the requirements of a growing national economy. Thus, as soon as the old open hearth shops had been restored, Soviet steelmakers were faced with the problem of further perfecting the process of steel melting and with the building of new plants. The construction of large metallurgical plants was already under way in the first Five-Year Plan: Magnitogorsk, Kuznetsk, Zaporozhstal and Azovstal.

At the existing metallurgical plants – Makeyevka, Dneprodzerzhinsk and others – the construction of new open hearth shops was begun.

In 1930 to 1931, new standardized open hearth shops were planned to have a productivity of about 1,000,000 to 1,200,000 ingot tons a year.

INTERESTING DATES 1930

APRIL. The U.S.S.R. SNK* decree regarding the formation of a Moscow Steel Institute from the set-up of the Mining Academy.

The Ilyich Mariupol metallurgical plant commenced operations.

JUNE. The Central Committee of the Communist Party of the Soviet Union passed a decree on the "Rebuilding of Urals Metallurgy by Converting the Charcoal Pig Iron Plants into a Base for Suppling the U.S.S.R. with High Grade Steel and Special Pig Irons".

First issue of the journal of the metallurgists of the Moscow Steel Institute.

The Sixteenth Session of the Communist Party of the Soviet Union passed a resolution on the " creation in the East of a second basic coal, iron and steel center for the U.S.S.R. by utilizing the high grade coal and ore resources of the Urals and Siberia".

* Council of the People's Commissars.

JULY. Foundations laid for blast furnace No. 1 of the Magnitogorsk metallurgical combine. The metallurgists' city – Magnitogorsk – was founded.

In such shops, it was intended to build standardized open hearth furnaces of 150 tons capacity fired with mixed gas and operating the scrap and ore process with 65 to 70% hot metal in the charge. The main feature of the new open hearth shops was that of continuous production. The following items were included in a shop: a self-contained and separate stockyard, mixer shop, ingot mold shop, ingot stripping shop, etc.

These principles formed the basis of many new open hearth shops. In addition, the shops were reconstructed to increase productivity up to 2,200,000 to 2,700,000 ingot tons.

As a result of building new open hearth furnaces, and further rebuilding old furnaces, steel production in 1932 had reached 5,900,000 tons.

The working class of the U.S.S.R., under the leadership of the Communist Party, successfully fulfilled the basic task of the first Five-Year Plan – they created their own advanced technical base for socialist reconstruction of the entire national economy.

In the second Five-Year Plan (1932-37), eighty-two new open hearth furnaces were commissioned. Open hearth furnaces were rebuilt on the lines of increased capacity and thermal input, greater crane lifting capacity and more robust construction of the buildings. The heat input of the furnaces was raised by increasing the feed of secondary air, increasing the draft, eliminating harmful resistances to the movement of the gases by redesigning the uptakes, installing gas valves operating on a new system, changing over to high calory (up to 2,500 cals per cu m) gas firing, insulation of furnace linings, redesign of ports, etc. In the new open hearth shops, the 185-ton furnaces were partially reequipped for charges of 300 to 320 tons and were tapped into two ladles.

With a view to improving the utilization of existing units, much work was carried out at many plants on the rationalization of production. The socialist competition developed in 1935 played an enormous part in increasing the capacity of open hearth furnaces.

Thanks to the measures introduced, the growth of technical culture and improvements in the qualifications of personnel, Soviet open hearth shops, at the end of the second Five-Year Plan, achieved a marked rise in productivity. Average daily production of steel per sq m of hearth area in 1937 was more than double that of 1928.

The eighteenth Session of the Communist Party placed before Soviet steelmakers, in the third Five-Year Plan, the task of reaching a level of 5.45 tons of steel per sq m of hearth area by 1942. The Session also indicated the principle trends to be followed in steelmaking: the third Five-Year Plan was the Five-Year Plan of special steels.

Soviet iron and steel men set to with enthusiasm to solve these problems.

By the fortification of technological discipline in all parts of the shops, by improvement and perfecting of the technology of casting steel, by the construction of new units and by increasing the efficiency of existing furnaces, the production of steel in the U.S.S.R in 1940 was 18,300,000 tons.

The attack of Hitler's Germany interrupted the peaceful development of the national economy. The war required large quantities of alloy steels for special purposes and formerly produced in electric furnaces or in small acid open hearth furnaces. The production of armor plate and other quality steels was successfully mastered in 190-ton open hearth furnaces. The severest economic control, the constant perfecting of technology and organization of production, a more complete utilization of local reserves, the mechanization of laborious processes – all this made it possible to keep up an uninterrupted supply of the requisite amounts of high grade metal for the war industry. During the war, twenty-nine open hearth furnaces were built in the eastern regions of the country and new steelmaking centers arose in regions which formerly did not possess a metallurgical industry – in central Kazakhstan, Uzbekistan, Georgia and Azerbaijan.

After the southern metallurgical regions had been liberated from the invaders, the Soviet people got down to the restoration of the destroyed plants. The years of the first postwar Five-Year Plan are characterized by a further growth in production.

In a short time, the open hearth plants of the south were restored on the basis of the new technology and

using the latest scientific and technical attainments. At the same time, the open hearth shops of the eastern plants were further modernized.

Most of the Soviet Union's open hearth furnaces, in the period 1944 to 1948, were equipped with devices for the automatic control of thermal conditions in melting: the process of combustion, valve reversal, pressure in the furnace chamber. Automatic control made it possible to obtain a strong flame, the requisite complete combustion, sufficient preheat in the checkers and an increase in the heat input to the furnace.

All new furnaces were equipped with automatic control. At the end of 1950, 85% of steel was produced in open hearth furnaces with automatic control of thermal conditions. As a result of the automatic recording and control of thermal conditions, the productivity of gas-fired open hearth furnaces was raised by 5 to 8% with a simultaneous drop in fuel consumption per ton of steel of 6 to 8%.

The development of furnace design work and an increase in furnace capacity were of prime importance. At the end of the five year period, more than half the steel produced was made in 185-ton open hearth furnaces. The number of large furnaces (with capacities of 300 tons and more) grew. The Soviet Union held first place in the world for the number of large open hearth furnaces in relation to its entire furnace population.

Operational experience with large open hearth furnaces showed without doubt their advantages over small furnaces: lower capital costs per ton of steel, lower fuel consumption per ton of steel produced, a reduction in the consumption of refractories and electric power per ton of steel and an increase in labor productivity.

It was the introduction of basic refractories for lining furnace roofs and the downstairs regions of the furnace that enabled the heat input of furnaces to be raised and tap-to-tap time to be reduced.

The successful trials, at the Hammer and Sickle plant, of the use of oxygen for speeding up the rate of melting in open hearth furnaces opened up new ways of raising steel output in existing units. At the end of the Five-Year Plan, the use of oxygen for steel melting in open hearth furnaces of various sizes was established on a production scale.

The open hearth shop of the Stalinsk metallurgical plant was the first in the world to put into practice the hot cooling of open hearth furnaces which considerably reduced furnace-down time for hot repairs because it prolonged the life of the water-cooled frames and lowered water consumption to one fiftieth to one hundredth.

Melting technology was perfected to a great extent.

Optimum conditions and methods of slag control were developed and introduced; refining methods were improved as were also the processes of deoxidizing and pouring. The production of new steels and the utilization of alloy scrap was put on a sound footing.

Automatic recording and control of thermal conditions, the use of new refractories the perfecting of furnace design coupled with an improvement in casting technology made it possible to effect a marked increase in technological and economic operational indexes of open hearth furnaces. Average daily output of steel per sq m of hearth area in 1950 had risen by 25% compared with 1940 while the production of open hearth steel per man in the open hearth shops increased by 43%.

The giant metallurgical combines of Magnitogorsk and Kuznetsk achieved great success; the amount of steel produced per sq m of hearth area in 1950 was 7.01 and 6.79 tons respectively.

The fifth Five-Year Plan was marked by a further increase in steel output. The constant growth in the construction of new open hearth shops, the increase in the capacity of existing units, the mechanization and automation of production, the intensification of technological processes, the perfecting of the technology and organization of production made it possible to produce 45,300,000 tons of steel in 1955 which is equivalent to 247% referred to 100% in 1940.

Magnesite-chrome basic roofs were widely used. Nearly all open hearth furnaces were equipped with them in 1956. In 1955, 60% of all open hearth steel was produced in furnaces having basic roofs while the figure for 1956 was 90%.

INTERESTING DATES 1931

APRIL.	The first Soviet blooming mill was assembled at the Izhorsk plant.
AUGUST.	The Central Committee of the Communist Party passed a resolution on the "creation of a third (after Donbass and Kuzbass) powerful coal base for the U.S.S.R. based on the coal deposits of Karaganda."
	The first large ferroalloy plant in the U.S.S.R. started in Chelyabinsk.
	The production of cold rolled products was commenced at the Hammer and Sickle plant — the first in the U.S.S.R.

1932.

FEBRUARY.	The first pig iron was produced at the Magnitogorsk metallurgical combine.
APRIL.	Blast furnace No. 1 produced the first pig iron at the Kuznetsk metallurgical combine.
JULY.	The Moscow tube plant started the building of effective enterprises.
OCTOBER.	Open hearth furnace No. 1 at the Kuznetsk metallurgical combine produced the first heat. The first electric furnace was put into operation at the Dyneprospetsstal plant,
NOVEMBER.	The first ingots were cogged in the Kuznetsk blooming mill.
DECEMBER.	The Makeyevka coke chemicals plant went into operation.

The factors affecting the progress of a heat in all its different periods were improved and conditions associated with the behavior and use of manganese during a heat were modified. At the foremost eastern plants, they went over to operating with low manganese iron which shortened tap-to-tap time.

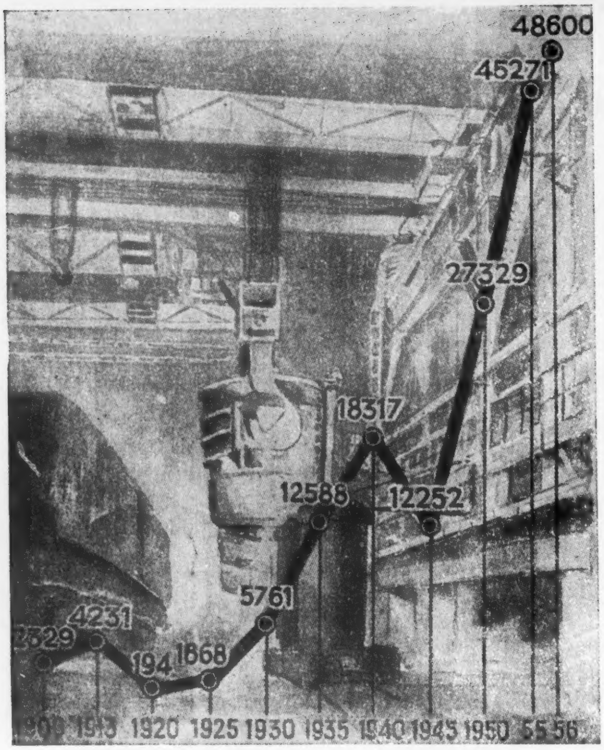
The changing over of most open hearth furnaces to hot cooling, the mechanization of bottom repairs, improved design and the change over to basic refractories led to a marked reduction in furnace-down time. In 1955, open hearth furnace-down time for hot and cold repairs was reduced, on average, by 20%. Total down time for open hearth furnaces at the Kuznetsk and Magnitogorsk combines in 1956 were 6.17 and 7.1% of calender time respectively.

Much preparatory work was carried out on the industrial use of oxygen in the open hearth process.

Steel production per head of population in 1955, compared with 1940, was up by 138%.

The Twentieth Session of the Communist Party of the Soviet Union put before steelmakers a grandiose plan for the further increase of steel production. The sixth Five-Year Plan is a Five-Year Plan associated with the extensive introduction of oxygen in the open hearth process, with the vacuum treatment of metal, with large open hearth furnaces, with the continuous casting of steel and with other new scientific and technical achievements.

Oxygen was widely used in 1956 at a number of large metallurgical plants (Zaporozhstal, Azovstal, Nizhne Tagil, Makeyevka) for intensifying combustion. Open hearth operation at these plants shows that the use of oxygen for enriching the air (up to 30% enrichment) produces a substantial effect. Calculations show that, by the use of oxygen alone (with air enrichment of up to 25% and oxygen consumption at the rate of 34 cu m per ton), the productivity of 185-ton open hearth Furnaces at Zaporozhstal increased by 20 to 22% and there was an average drop of 16% in fuel consumption per ton of steel. At Azovstal, as a result of using oxygen for air enrichment (up to 24 – 25%) and of replacing silica roofs by magnesite-chrome roofs, productivity of the 350-ton tilting furnaces operating on a 73 – 75% phosphoric hot metal charge, increased by 19%, fuel consumption was



Overall growth of steel production in the USSR
(in thousands of tons).

cut by an average of 6% with an average oxygen consumption of 35 cu m per ton. A high efficiency in the use of oxygen was achieved at the Nizhne Tagil metallurgical combine. With oxygen consumption at 24 – 26 cu m per ton, furnace productivity was raised, on average, by 20% and fuel consumption per ton of steel was cut by 18%. One of these 370-ton open hearth furnaces at the Nizhne Tagil plant produced 295,900 tons of steel in 1956.

The most effective use of oxygen is for the direct lancing of the bath since an increase in productivity and a reduction in fuel consumption are achieved in this case with a much lower oxygen consumption – about 5 to 6 cu m per ton of steel.

The technology of the use of oxygen for direct oxidation of the bath must be perfected in the future. Optimum conditions for the wider application of this method must be developed by the concerted efforts of plant workers and research institutions. The most promising possibility is evidently a combination of the use of oxygen for intensifying combustion and its use for lancing the bath.

It must, however, be acknowledged that the use of oxygen is economically justified only when all auxiliary equipment in open hearth shops has been cleared of bottle-necks. In this connection, the great technical and organizational problems associated with the improvement of operations in all parts of the open hearth shops must be solved.

The most effective method is the use of compressed air for intensifying the processes of combustion. As the experience of the leading open hearth shops shows, the blowing of compressed air into the gas port enables tap-to-tap time to be cut by an average of thirty minutes.

At present, new open hearth shops are being built with furnaces of 250 and 500 tons' capacity, serviced by 350-ton lifting capacity casting cranes and 10 ton charging machines. In these shops, a steel output of up to 5,000,000 tons a year – previously unheard of – is intended.

The complex of the new open hearth shops includes a number of self-contained departments.

The most important progressive measures in open hearth production are the wide application of the control of liquid steel temperature by means of immersion pyrometers, the vacuum treatment of metal in the ladle and during pouring, a further improvement in metal quality and the application of continuous casting of steel on a full production scale.

The most promising possibilities as regards increasing the production of steel are the prior treatment of iron with oxygen and the changing over the gas-fired open hearth furnaces to cold, high calory gas firing. Prior treatment of iron with oxygen is one of the variants of direct oxidation. The blowing of iron can be carried out in the ladle, in the mixer, directly in a specially designed tapping spout or in a rotary furnace. When the semiproduct (preblown iron) is used, there is a substantial rise in the productivity of open hearth furnaces.

In the coming years, a number of open hearth furnaces and shops will go over to natural gas firing in the Soviet Union. Open hearth furnaces operating on high calory gas are cheaper and simpler to construct and are more easily automated.

The enormous successes achieved by Soviet steelmakers became possible only because of the great cultural and technical growth of the Soviet peoples tirelessly completing their efforts towards higher qualifications and the mastering of new techniques.

Workers of the open hearth shops, together with a whole army of metallurgists, will be in the front ranks of the fighters in the struggle to fulfill the great constructional tasks of communism and the plans laid down by the great Communist Party.

INTERESTING DATES 1933.

FEBRUARY.	Blast furnace No. 1 with a capacity of 930 cu m was put down at the Voroshilov plant. The Zestafon ferroalloy plant went into operation. The Zaporozhe ferroalloy plant went into operation.
JUNE.	The first blooming mill in the U.S.S.R. went into operation at the Makeyevka metallurgical plant.
JULY.	The first steel was produced at Magnitogorsk. Blast furnace No. 3 was blown in at Magnitogorsk. The blooming mill went into operation at Magnitogorsk.
AUGUST.	Blast furnace No. 1 at Azovstal produced the first iron.
OCTOBER.	Blast furnace No. 1 produced the first iron at the Zaporozhe plant.
NOVEMBER.	The 630 mm mill went into production at Magnitogorsk.
DECEMBER.	The 450 mm mill was commissioned at Magnitogorsk. Blast furnace No. 4 was blown in at Magnitogorsk.

CONVERTER PRODUCTION

As a legacy from Tsarist Russia, the Soviet Government inherited an extremely backward metallurgical industry (especially as regards converter production) equipped with outmoded, low productivity plants. In acid converter shops, there was a predominance of manual labor and of small scale units and production.

In the first years after the civil war, Soviet metallurgists tackled the restoration of the shops; many units were mechanized and enlarged.

During the first and second Five-Year Plans (1928 to 1937), a thorough reconstruction of acid converter shops was undertaken. At the Petrov and Dzerzhinsk plants, 600-ton mixers replaced the 100-150 ton gas-heated mixers. This made it possible to obtain pig iron of greater uniformity, to maintain its temperature and, consequently, to improve metal quality and to reduce the period of the blow. The bringing up and decanting of hot metal into the converters were mechanized.

A number of processes in converter shops involving heavy labor were then mechanized at the Voikov, Petrov, Dzerzhinsk and Yenakiyevka plants; slag removal, the changing of tuyeres and the removal of skull (using pneumatic tools), the preparation of the mass for converter bottoms and the ramming of bottoms. All repair work and operations connected with the charging of converters and cupolas for melting the deoxidizers were mechanized.

The application of production control to casting raised the technical and economic operational indexes of acid converter shops. Until 1935, the acid converter shops of the southern plants treated pig irons with a high silicon content (1.8 to 2.3%). The composition of the initial materials and the technology applicable in blast furnaces made it possible to obtain a low sulfur content (a necessary condition for acid converter iron) when operating only with highly basic slags with high coke consumption which gave rise to a high silicon content in the iron. Operating on high silicon irons was, to a certain extent, explained by bad production organization with too many pauses between heats requiring an excessive amount of fuel for heating the converter linings.

After the shops changed over to irons containing 1.2 to 1.5% silicon and 0.04 to 0.05% sulfur, converter operation was markedly improved. The period of the blow was shortened, slag bulk was reduced, iron consumption was diminished, the yield of good ingots was increased, converter lining life was prolonged as the formation of skull inside the converter was eliminated and the life of the ceramic tuyeres in the plug bottoms was increased.

The replacement of the scrap used for cooling the metal, by ore reduced blowing time by 10 to 12%, thus increasing converter productivity. The Yenakiyevka plant was the first to try out this method which was quickly introduced at the Petrov and Dzerzhinsk plants.

A marked rise in the productivity of acid converter plants was also attained by increasing the capacity of the converters (see table).

The productivity of all acid converter plants for the period 1930 to 1940 doubled while converter capacity increased by about 50%. Operational practice showed the advantage of overcharging converters to increase their productivity and proved that steel quality depends mainly on pig iron quality (uniformity of chemical composition and temperature), extent of afterblow and the method of dephosphorization and pouring.

From year to year, the quality of acid converter steel improved. In 1939, acid converter shops went over to the production of low carbon steel without an afterblow. Previously, metal was blown to a carbon content of 0.03 to 0.04% which was accompanied by an iron loss and a deterioration in metal quality. A new

Plant	Charged weight	Effective volume of converter in cu m		Annual productivity in thousands of tons
		Total	Per ton of charged weight	
Petrov plant				
1930	10	11.9	1.19	164
1940	16.3	11.9	0.73	340
Dzerzhinsk plant				
1930	12	13	1.08	230
1940	17	13	0.76	460
Yenakiyevka plant				
1930	10	13	1.3	170
1940	15	13	0.87	337

technology was used which enabled the blow to be finished at a carbon content of 0.06 to 0.10% and this had a very beneficial effect on steel quality.

In 1938, a new method of deoxidizing metal by means of complex liquid deoxidizers was tested and successfully introduced for improving the quality of acid converter rail steel; the preparation of ingot molds was also improved.

Much work has been done by the workers of the Kerchensk Voikov metallurgical plant on improving the operation of basic converters and the quality of basic converter steel. In view of the low impact strength and the marked tendency towards aging of basic converter rimming steel, the Kerchensk plant organized the production of killed basic converter steel deoxidized with aluminum (1.0 to 1.2 kg per ton) and intended for use in structures subject to dynamic stressing and for service at low temperatures. This steel satisfactorily withstood an impact test both at normal and low temperatures.

A great achievement of Soviet metallurgy was the construction and putting into operation, in 1939, of the acid converter shop at the Krivorog plant, containing 35- ton converters. As regards the scale of production, this was the largest and best equipped converter plant in Europe. Here was the most modern equipment: electric drives for turning the converters up and down, powerful electric blowers for the blast, hot metal ladle buggies, steel ladle cars, lifting buggies, slag cars, strippers for the pouring bays, etc. All the equipment was manufactured in the U.S.S.R.

The shop rapidly attained a high productivity. The blowing period for a 35 ton heat was 14 to 15 minutes; the life of converter bottoms and linings was prolonged. This was the first acid converter shop in the U.S.S.R. with a high production capacity designed for rapid frequency of heats and with maximum mechanization of work involving heavy labor.

INTERESTING DATES 1934.

JANUARY. A Mannesmann shop was commissioned at the Ilyich plant.

FEBRUARY. The Seventeenth Session of the All-Union Communist Party confirmed the second Five-Year Plan for the development of the national economy of the U.S.S.R. (1933-1937).

AUGUST. Blast furnace No. 1 produced the first iron at the Krivorog plant.

DECEMBER. Blast furnace no. 1 with a capacity of 1000 cu m was commissioned at the Novo-Lipetsk plant.

Blast furnace No. 4 was blown in at the Kuznetsk metallurgical combine.

1935.

JUNE. The Novo Tula metallurgical plant was started up – blast furnace No. 1 produced the first iron.

NOVEMBER. Blast furnace No. 2 with a capacity of 1000 cu m was blown in at the Novo Lipetsk plant.

AUGUST. The 250 mm mill was commissioned at the Magnitogorsk metallurgical combine.

While the old shops were being restored and rebuilt and new shops were being constructed, groups of converter production specialists were increasing in number and were increasing their experience; Soviet specialists, – engineers, technicians and scientific workers – contributed enormously to the perfecting and development of converter production.

Prior to the second world war, converter production in the U.S.S.R. had reached a high technical level. The proportion of acid converter steel related to the total amount of metal production was insignificant, however, and, in the ferrous metallurgical plants, it dropped from 17% in 1932 to 9% in 1939. This was due to the fact that converter steel was inferior in quality to open hearth steel and consequently, most effort was devoted to the production of open hearth steel.

At the Chussovo metallurgical plant, during the second world war, a duplex shop was put down for converting vanadium pig iron by the acid converter process (two 20-ton converters).

Before the open hearth furnaces were there, the acid converters worked a converter-converter duplex process. This made it possible to produce free-cutting steel and to obtain the costly vanadium slag for the production of ferrovanadium. When the open hearth furnaces went into operation, the converter-open hearth process of duplexing was developed for the conversion of vanadium pig irons.

After the war, Soviet metallurgists worked hard at the restoration of plants and at the reconstruction and modernization of the converter plants which had been destroyed. An exception was the acid converter shop of Yenakiyevka which was restored during the war in record time without radically altering and at which Soviet engineers in 1948 to 1949, developed the method of producing carbon steel in which the blow was finished at a certain carbon content.

In the plant laboratories, a carbometer was made and a new method of express analysis was developed for determining the carbon content of steel. This method of analysis was sufficiently accurate and rapid (about one minute) to permit the new technology of blowing, involving the stopping of the blow at a certain high carbon content, to be introduced in practice.

Completely new shops were built at the Petrov and Dzerzhinsk plants. At the Dzerzhinsk plant, by removing some old shops, a new shop was set up for the manufacture of bottoms, the pouring bay was enlarged to several times its former size, a new converter building was put up and converters were provided with electric devices for turning up and down.

At the Petrov plant, a new converter shop building was erected and a new building for the mold shop, new converters were constructed and new casting cranes provided; hydraulic jacks were replaced by lifting buggies; standard slag cars were used to mechanize slag removal.

Casting cars were used in both shops and this greatly eased labor conditions and increased the output of the different bays.

In 1950, as a result of a number of improvements, a substantial betterment of acid converter rail steel quality was achieved. At the Petrov and Dzerzhinsk plants, the Yenakiyevka method of blowing began to be used in which the blow was stopped at a certain carbon content. Closed end, wide end up molds were used with hot tops for the production of acid converter rail steel.

In view of the short time required to produce a heat of converter steel and the large number of operations, it is easy to understand how enormously important is the precise and correct organization of production.

As a result of detailed study of each production operation, of sometimes combining certain of these, elimination of delays, mechanization and improvement of the organization of cold repairs of converters (with a change of the entire lining), the hot repairs of converters have been greatly speeded up as also has the preparation of steel casting ladles and of hot tops.

In December,1956 at the Orsk-Khalilovo metallurgical combine, converters of 40 cu m volume were

commissioned. The acid converter department of the duplex shop was designed for high productivity; there is here a 600-ton mixer, converters and chimneys, a ladle preparation and pouring bay, an ingot mold preparation shop, a shop for making bottoms and a blower house.

The acid converter shop at the Orsk-Khalilovo plant is destined for the production of a semi-product suitable for further processing in the open hearth furnaces. The production of steel from Khalilovo iron containing about 3% Cr and 1% Ni is a complex problem for the solution of which it is intended to use the duplex process.

Until the open hearth furnaces are in production, The Orsk-Khalilovo converters remove the chromium from the iron and the semi-product is shipped to other plants. The semi-product is sometimes poured into ingot molds and sometimes over the pig casting machines of the blast furnace shop.

The use of oxygen blast opens up wide horizons for the development of converter production in the U.S.S.R.

The development of a method of steel production utilizing technically pure oxygen was begun as early as 1934 in the U.S.S.R by N.I. Mozgov. Later, oxygen blast trials were carried out at the Kosogorsk and Mytishchinsk plants. Systematic investigations and a development of the process of oxygen converter production were undertaken from 1944 onwards under the direction of Academician I.P. Bardin at the Kuznetsk metallurgical combine, in the laboratories of TsNIIChM* and at the Dynamo, Novo Tula and Yenakiyevka plants.

Research work carried out by TsNIIChM together with the Novo Tula and Yenakiyevka plants made it possible to obtain the requisite data to organize the process of top blowing of open hearth iron with oxygen in the converter on a production scale.

At the end of 1956, the acid converter shops of the Petrov plant were converted to oxygen blast. The plant was completely rebuilt, equipped with scrubbers for gas cleaning and an oxygen plant.

Experience of the industrial use of oxygen blast at the Petrov plant during the year shows that the technology of the use of oxygen is simple and makes it possible to produce metal which is equal in quality to open hearth steel.

At the end of 1957, the building of the largest converter shop in the U.S.S. R. is to be completed – namely at the Krivorog metallurgical plant where open hearth pig iron will be treated in converters with basic linings and top blown with pure oxygen, using water cooled lances.

In view of the favorable conditions relating to the development of ferrous metallurgy on the basis of the phosphoric ores of the Kerchensk deposits and also on the basis of the phosphoric ores of the Ayat and Lissakovsk deposits in the Kustanai region of the Kazakh Soviet Socialist Republic, the use of the basic converter process is faced with the most optimistic future in the U.S.S.R.

In this connection, it is essential to work out plans for new converter shops , keeping in mind the necessary conditions for the use of oxygen in steelmaking.

One of the problems which must be solved in the building of new converter shops will be the further development of equipment for cleaning the gases which escape from the mouth of the converter during the oxygen blowing process. Special attention will have to be paid to the improvement of refractories used in converters operating on oxygen blast.

The results obtained from the use of oxygen in the converter process during recent times show that the converter process is in a new stage of development and that the possibilities of its development in the U.S.S.R. are enormous.

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* Central Scientific Research Institute of Ferrous Metallurgy.

THE ROLLED PRODUCT INDUSTRY

The development of ferrous metallurgy in Tsarist Russia dates from the eighties of the nineteenth century. The growth of rolled metal production was connected with the large scale construction of railroads at that time.

In the absence of heavy machine industry and because of extremely limited industrial construction, the demand for rolled product in Tsarist Russia was determined by the needs of the indigent village which could not permanently ensure an adequate market for rolled metal. Hence the frequent periodic demand crises of rolled material in Tsarist Russia.

The instability of demand and the easy availability of cheap labor provided by the declining peasantry were not conducive to the mechanization of production processes. As a rule manual labor was widely used in the rolling plants. The existing blooming mills were not used for the reduction of large ingots into billets or slabs, but were in effect roughing stands of rail structural mills. The starting material for rolling was the small ingot. No means were employed for the preparation of metal for rolling. The low standard of technology conformed to the general technical backwardness of Tsarist Russia.

In the first and second Five-Year Plans (1928 – 1937), when the second coal mining and metallurgical center was being established in the East and the construction of car, tractor, chemical and other factories in the most important branches of industry was initiated, several measures with regard to the modernization of existing equipment, the construction of new modern rolling mills, and the mechanization of labor-consuming operations were carried out.

The first modern mechanized blooming mills were put into operation at the Kuznetsk Metallurgical Combine in 1932 and at the Magnitogorsk Combine in 1933.

The putting into operation of these blooming mills marked the transition to the modern technology of rolling. The starting material for rolling consists of, instead of small ingots, roughed material: blooms for rail structural mills and slabs for steel plate mills.

SIGNIFICANT DATES

1937

MAY. The first blast furnace of 1300 cu m volume in the world was put into operation at the "Zaporozhstal" Works. The first continuous thin sheet mill in the USSR was put into operation at the "Zaporozhstal" Works.

1939

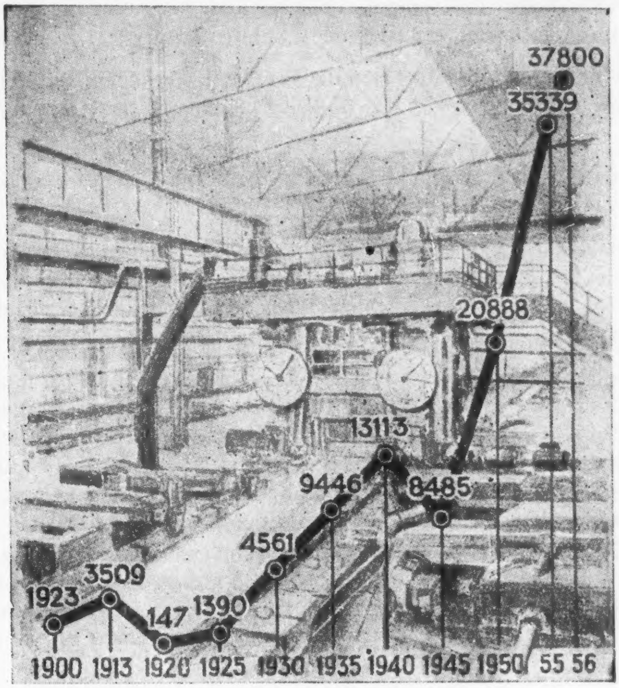
MARCH. XVIIIth Congress of the VKP (b) (All-Union Communist Party of Bolsheviks) approved the third Five-Year Plan for the economic development of the USSR (1938 – 1942).

AUGUST. The largest 400 – ton - hearth furnace in the country was put into operation at the "Azovstal" Works.

SEPTEMBER. On the basis of the Central Editorial Office for Literature on Ferrous and Non-Ferrous Metallurgy (GONTI – State United Scientific and Technical Press), the

State Scientific and Technical Press for Literature on Ferrous and Non-Ferrous Metallurgy, — the Matalurgizdat (Metallurgy Press) — was established.

Modern technology of rolling large ingots in two stages (billet — final section) results in a sounder texture of rolled material (with a large initial cross section of the ingot, the total reduction in the course of the rolling process is considerably larger than in the case of a small ingot). Moreover, the two-stage process makes for a better surface on the final product through the dressing of blooms and slabs.



Growth of rolled product output in the USSR (in thousands of tons).

In the second Five-Year Plan the first Soviet blooming mills built by the Izhorsk Works were put into operation at the old Makeevsk and Dzerzhinsk Works, and a slabbing mill constructed by the Novo-Kramatorka Machine Works was installed at the "Zaporozhstal" Works.

In the years of the second Five-Year Plan, the following modern mills were built and put in to operation: the rail structural mill with intermittent heating of blooms at the Kuznetsk Metallurgical Combine; the large section mills 500 with a zigzag arrangement of the stands, with only one pass allowed on each stand, at the Kuznetsk and Magnitogorsk Metallurgical Combines; the continuous billet mills 630 and 450 at the Magnitogorsk Combine and at the Makeevsk Works; the continuous strip mill at the Magnitogorsk Combine; the mechanized spring mill at the Chusovsk Works and others.

A great deal was done with regard to the intensification of production at the existing rolling plants, the mechanization and modernization of their equipment, and the elimination of bottle-necks in rolling mills. Heating furnaces were converted to gas firing; the delivery and removal of the metal to and from the furnace were mechanized; the low-power steam and gas engines were replaced by more powerful electric motors with devices for speed control (the Enakievsk and the Sulinsk Works); steam engines on the reversible mills were replaced by electric motors with Ilgner machines (the Petrovsky Works); tilting and lifting of rolled material were mechanized; the bottle-necks in cutting and straightening of rolled materials were eliminated by modernizing the cutting and straightening machines or replacing them by faster ones.

As a result of the measures carried out, the output of rolled product reached 4.4 million tons at the end of the first Five-Year Plan and 13 million tons at the end of the second Five-Year Plan in 1937.

The production of rolled material during the first two Five-Year Plans is characterized by substantial changes in the grades of material. Whereas up to 1928 the amount of high quality steels constituted only 90,000 tons of the total rolled product, at the end of the first Five-Year Plan it constituted 700,000 tons and at the end of the second Five-Year Plan the output of high grade steel products amounted to 2.5 million tons.

During the period of the first two Five-Year Plans the establishment and large scale development of the production of ball-bearing steels, hollow drill, graded carbon and alloy steels, deep and very deep drawing car plate, stainless, magnetic, electrotechnical, and other steels with special physical properties took place.

Several plants manufacturing ordinary rolled material were re-equipped for the rolling of high grade carbon and alloy steels (Serov, "Krasnyi Oktyabr," "Serp i Molot," Stalinsk in Donbass, and the Beloretsky Works).

The construction of new mills and the enlargement of the capacities of the existing ones were continued in the third Five-Year Plan.

During the Great Patriotic War the gigantic task of transferring the southern industry to the East and of putting the uprooted equipment into operation again was performed. The efforts of metallurgists and rolling mill operators, as well as of all Soviet people at home, ensured a continuous supply of metal to the front and the final victory over fascism.

In the post-war years a large scale modernization of rolling plants was carried out in the process of the rebuilding of the metallurgical industry in Donbass and the Dnieper region. Rail structural mills 280 and 360 at the Enakievka Works, mills 250, 350 and 400 at the Stalinsk Works, and mill 260 at the Komintern Works were rebuilt on a new technical basis: mechanized coolers were installed, the thermal capacity of heating furnaces was increased and new, more powerful motors for mill drives replaced the old ones. The reconstruction of some rolling mills in the South amounted in effect to the erection of new, more efficient equipment. Thus in the rail structural mills of the Petrovsk and Dzerzhinsk works modern recuperative soaking pits were erected and high-power motors were installed (finishing stands were provided with separate drives); in mill 330 of the Kuibyshev Works in Kramatorka a new, large capacity heating furnace designed by Stalproekt and employing blast furnace gas was erected, and the finishing train was equipped with transfer and by-pass equipment providing complete mechanization of material delivery to the rolls.

The speed of rolling in the contemporary mills, in those built in the first and second Five-Year Plans, and after the Great Patriotic War was increased (the wire drawing mill, mill 300 – 3, and others at the Magnitogorsk Combine), the temperature of ingots at charging into the soaking pits was raised, and so was the specific weight of ingots.

Extensive work was carried out with a view to increasing the size of ingots and billets: in order to ensure satisfactory conditions for the gripping of the metal by the rolls, it was necessary to change the roll design and to increase their diameter.

In individual cases the dimensions of starting billets for rolling were reduced. For instance, in Mill 300-3 at the Magnitogorsk Combine, for the manufacture of small section, the billet of 80 x 80 mm was adopted instead of the previously employed 100 x 100 mm billet, which had to be cut in half before entering the first stand so that the rolled material could be accomodated on the coolers. On rolling billets of smaller cross-section the material is easily accomodated on the cooler, thus ensuring a higher operating efficiency of the mill.

Other measures were carried out with regard to a better utilization of rolling equipment capacity: operation according to a counter time scheme, the organization of inter-works schools, the application of innovators practices, the combining of trades, the introduction of cost accounting and an extensive application of overlapping rolling. The adoption of new type cast rolls ensured their high strength and the durability of the passes. The welding-on of steel rolls with wear-resistant metal and the introduction of roller lines of high durability were conducive to more regular working of rolling mills and a reduction in idling.

The new specialization system of the rolling mills, approved by the government in March, 1953, took into account post-war changes in the regional requirements of rolled material and promoted the "mounting "

of rolled material, i.e., an increase in the size of batches of one kind of material.

It is seen from Table 1 that all the measures undertaken ensured a substantial increase of rolled product output in busy times in the old as well in the new rolling mills (hourly output in 1950 is taken as 100%)

TABLE 1

Works	Mills	Year 1955	Year 1956
Enkievka	280	133	165
	360	132	138
Komintern	260	122	165
	250	198	206
Stalinsk (Donbass)	350	115	120
	400	124	131
Petrovsk (% based on 1940)	Rail structural	205	227
Dzerzhinsk	Rail structural	146	147
Kuibyshev in Kramatorska	330	163	174
	Wire drawing	124	126
Magnitogorsk	300 – 3	112	117
	Blooming mill No. 3.	144	183

The growth of rolled material production on the existing equipment was also promoted by the introduction into the mills of a continuous schedule of operation with regular stoppages for planned preventive overhauls, and the adoption of unit-by-unit overhaul, making possible a reduction in the idling time of the machinery on overhaul by more than half on account of the elimination of the work of dismantling and assembling the units.

SIGNIFICANT DATES

1940

JUNE. The first batch of pig iron was obtained from blast furnace No. 1 at the Novo-Tagil Metallurgical Works.

At DZMO* the first large scale experiments in the world on the manufacture of blast furnace ferroalloys with oxygen-enriched blast were carried out.

AUGUST. Blast furnace No. 4 of 1300 cu m volume was put into operation at the "Azovstal" Works.

SEPTEMBER. The first steel batch was obtained at the Novo-Tagil Metallurgical Works.

Staggered overhauls, an effective means of reducing idling periods, are when the total amount of a major overhaul is split into several periods, a part of the major overhaul work being carried out during scheduled short-time stoppages.

The best results with regard to cutting down of idling periods were achieved at the Magnitogorsk Combines, where a preliminary assembly of transmission shafts, separate reduction gears, driving and working stands of rolling mills are applied. Owing to the thermal treatment of components and the welding-on of fast wearing out parts with hard alloys, a substantial extension of the serviceable period of working parts between overhauls has been achieved. Table 2 illustrates the effectiveness of unit-by-unit and staggered overhaul and the extension of the working period of components between overhauls at the Magnitogorsk Combine (according to the data of head mechanic N.A. Ryzhenko).

* Dnepropetrovsk Metallurgical Equipment Plant.

TABLE 2

Mills	Number of overhauls		Total time of overhauls, hrs	
	Year 1950	Year 1955	Year 1950	Year 1955
Blooming mill No. 2	13	10	438	360
300 – 2	26	17	540	400
250 – 1	25	17	420	440
Medium plate	26	15	608	456

Along with further work on the intensification of rolling processes, the saving of metal constitutes an important potential source for ensuring the needs of national economy in rolled material. An immediate task is the development of the manufacture of economic shapes of rolled material – lightened, thin wall sections (H-beams and channel beams of light type, car wheel sections); new forms of steel reinforcement of improved physical properties for reinforced concrete; rails of heavy section (R– 65 and R – 75); rational shape joints for railroad transport ("K" type rail joints); low alloy steel for structural building, ship building, and machine construction; high alloy steel for special service conditions (stainless, heat-resisting, etc.); new forms of sheet iron allowing a reduction in tin consumption, – black varnished, electroplated, one-side plated; thin grade of iron sheet.

A very important task is a substantial increase in the specific weight of thin sheet production, including cold rolled steel sheet, extension of the types of shaped sections and periodical section for machine construction, organization of the manufacture of compound shaped sections required in small quantities, wide beams on the existing rail structural mills, bent sections from sheet and strip.

A complete mechanization and automation of all the operations from charging the metal into the heating furnaces to the removal and loading of finished material, the application of modern methods of inspection of the rolled products, and the installation of accurate rolling stands should make the rolling plants of Soviet metallurgical works highly efficient and ensure the increasing requirements with regard to rolled products – accuracy, satisfactory surface and high mechanical and physical properties.

The establishment and the introduction in the production processes of new rolling mill designs – planetary multi-roll mills for rolling wide and thin strips; three-roll mills with transverse helical action for rolling periodic shapes of circular cross section, continuous mills for rolling section and plate steel – will ensure high technical and economical indices of the rolled steel industry.

Under the leadership of the Communist Party and the Soviet Government, problems of further development of the rolled product industry will be solved in a short time.

SIGNIFICANT DATES

1941

MARCH. The first issue of the scientific and technical journal "Steel" was published.

JUNE. Beginning of the Great Patriotic War of the Soviet Union against fascist Germany.

JULY. For the first time in the history of metallurgy, armor plate for tanks was rolled in the blooming mill of the Magnitogorsk Metallurgical Combine.

1942

FEBRUARY. The "Amurstal" Metallurgical Works was put into operation.

1943

JANUARY. The Aktyubinsk Ferroalloy Works, the very first enterprise in ferrous metallurgy of Kazakhstan, was put into operation.

THE TUBULAR PRODUCTS INDUSTRY

The tubular products industry of our country was established essentially under the Soviet regime.

Prior to the October Revolution the annual output of tubular products in Russia was only a few tens of thousand tons, constituting 2% of the total rolled product output.

After the civil war and its resulting devastation, the tubular product industry was rebuilt at a faster rate than other branches of ferrous metallurgy, since a special need for tubular products was felt. Pipes were required in the aircraft industry, in the petroleum industry, in tractor manufacture, locomotive manufacture and other fields. As early as 1925 the output of tubular products reached the level of 1913, while as far as the rolled products were concerned, this level was reached only in 1928.

During the first Five-Year Plan the following new tubing mills were put into operation: Moscow, Leningrad, Zhdanov, Kuibyshev, Khartsyz and others; the Lenin and the Andreev Works were reconstructed, and the construction of the Nikopol and the Pervouralsk works was begun.

In the period of the second Five-Year Plan, production was begun at the Pervouralsk New-tubing Works and the Nikopol South-Tubing Works; new plants were erected at the Andreev, the Liebknecht, the Kuibyshev, the Vyksunsk Metallurgical, and the Moscow Tubing Works.

The construction of new tubing plants and at the same time the modernization of many old mills were continued in the pre-war years. In those years the production of seamless tubes was mainly developed in order to satisfy the needs of the petroleum, machine-building and defense industries. Welded gas pipes were manufactured mainly in furnace welding stationary mills, and large diameter pipes – in mills employing water-gas welding. Manufacture of tubes by means of electric welding was only in the initial stage.

In 1940 the Soviet Union was the second country in Europe (after Germany) in tube manufacture, having produced about 1 million tons of tubing.

During the years of the Great Patriotic war, the defense industry was adequately supplied with tubing, owing to the heroic efforts of tubing mill operators. Most of the tubing mills of the southern works were transferred and installed in the Urals.

Thus the Chelyabinsk Tubing Works was established and the Pervouralsk New-tubing and the Sinarsk Tubing Works were fully re-equipped.

After the defeat of Hitlerite Germany, the reconstruction and the development of the southern tubing industry began. By 1947, the industry approached the pre-war production level. In the first post-war years the output of tubes increased mainly on account of the reconditioning of the equipment which was in operation before the war. From 1954 onwards, tube production increased mainly on account of the putting into operation of new equipment produced by Soviet machine constructors.

In the post-war years Soviet tube rolling units with automatic mills were put into operation: mills 140, 250, and 400 mm, whose special design features made it possible to obtain tubes with a more uniform wall thickness and a thinner wall, as well as to reduce the upper tolerance limit from 12.5 to 10%.

SIGNIFICANT DATES

1944

JANUARY. The Enakievka Metallurgical Works began operation after a partial reconstruction.

The first open-hearth furnace was put into operation and the construction of tube rolling plants was completed at the Chelyabinsk Tube Rolling Works.

The Kuznetsk Ferroalloy Works was put into operation.

MARCH. The first open-hearth furnace put into operation at the Uzbek Metallurgical Works.

The first Bessemer plant in the Urals was put into operation at the Chusovsk Metallurgical Works.

APRIL. Blast furnace No. 3 was put into operation at the Novo-Tagil Metallurgical Works.

Blast furnace No. 1 of 930 cu m volume was put into operation at the Chelyabinsk Metallurgical Works.

DECEMBER. The Central Scientific Research Institute of Ferrous Metallurgy (TsNIIChM) was established on the basis of the Scientific Research Institute for High-grade Steel and Ferroalloys and of the Laboratory of Rolling.

The Kazakhstan Metallurgical Works in Temir-Tau was put into operation.

For the manufacture of thick walled, high precision tubes used for roller bearings and ball bearings, a special plant was designed and put into operation, provided with modern equipment with a three-roll rolling mill to make 50 – 160 mm diameter and up to 7 m long tubes from rolled billets of carbon, alloy, and high alloy steels. If necessary the mill can be quickly readjusted for rolling of different size tubes. Furthermore, the adoption of cooled die in the piercing stand allowed a full automation of the unit.

There are many new mills for cold rolling of tubes in tube-drawing plants. The mills of types KhPT-32, KhPT-55, and KhPT-75, designed by our machine constructors, are not inferior to similar foreign mills, in spite of some short-comings.

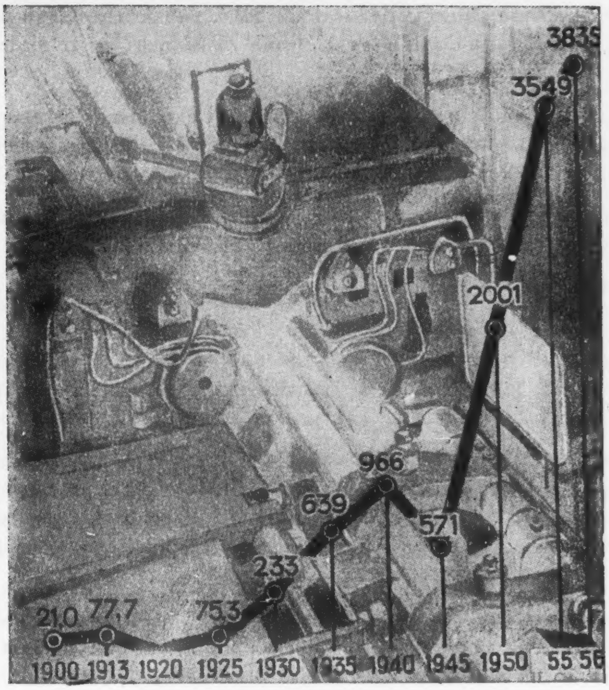
At present some new types of mills for cold rolling of tubes have been developed, tested, and adopted in the industry. At these mills there are 3 – 6 small-diameter rolls with constant section passes, instead of two large diameter rolls mounted on rolling bearings with passes of varying profile. The journals of the rolls are supported on specially shaped plates mounted inside the thick-walled tube of the working carriage of the mill. On the reciprocating motion of the carriage the rolls move on the plates, approach each other, and compress a part of the billet delivered at the commencement of the working move of the carriage.

Especially thin-walled, small-diameter tubes, with wall thickness 0.01 – 0.006 of the outer diameter of the finished tube, can be rolled on these mills.

A disadvantage of this method is the necessity of rolling the tubes at a small reduction of their outer and especially inner diameters. Therefore it is expedient to apply these roll mills to rolling extremely thin-walled tubes.

One of the most economical methods manufacturing thin-walled pipes of 200 – 300 mm diameter is continuous helical welding (this is the only method for pipes with the ratio of the diameter to the wall thickness equal to more than 80). Owing to the helical form, the seam is loaded by 20 – 25% less than a longitudinal one. Moreover, pipes of various diameters can be welded from the same width strip.

At present pipes of 420 – 630 mm diameter, 5 – 7 mm wall thickness, and up to 18 m long are made on a helical welding mill. However, the seam quality in these pipes is not yet adequately high, for it is affected by the crescent-like shape of the initial strip and by the forming machine. Work is being done at present on the adoption of internal-seam pipe welding.



Growth of tubing manufacture in the USSR (in (thousands of tons).

A new plant for the manufacture of large-diameter pipes was put into operation in 1956 in Chelyabinsk. The technology of pipe making in this plant differs radically from the methods previously employed. The main features of the new process are:

a) the continuity of the production, allowing a maximum mechanization and automation of the process;
b) the shaping of pipe material from 12.5 m plates on powerful hydraulic presses;
c) automatic external and internal welding of pipes;
d) expansion of pipes to a measured diameter, the pipes being laterally strengthened by powerful hydraulic press – expanders and simultaneous shaping of pipe ends and hydraulic testing.

Over ten highly mechanized and automated mills for the manufacture of tubes of 10 – 60 mm diameter by electric resistance welding were put into operation in recent years. The speed of welding at an ordianary current frequency reaches 30 m/min. In the very near future these mills will begin to use higher frequency current (150 – 250 cycles per sec) which will make it possible to increase the speed to 40 – 45 m/min.

At the present time the manufacture of tubes from stainless and other high alloy steel by argon arc welding has been mastered. Successful experiments on the adoption of atomic hydrogen welding are being carried out.

The manufacture of screwed-on brazed tubes of 6 – 15 mm diameter has been started. These tubes have two layers; the beginning of the internal layer overlaps the end of the outer layer. The amount of overlap is a very important technological parameter, since the strength of the tube depends on it; if the overlap is small the wall thickness at the joint will be smaller than the thickness of the tube wall.

The screwed-on brazed tubes have a high fatigue strength owing to the brazing of the layer on the whole area of contact. Copper partially diffuses into the tube metal.

The manufacture of new types of tubes has been introduced, for instance, extra thin-walled and electro-polished for the atomic energy industry, thin-walled seamless for contemporary aircraft industry, uniform strength drive pipes and drilling pipes for the petroleum industry, special shape pipes for the machine building industry, and many others.

A substantial rise in tubular product output is envisaged in the sixth Five-Year Plan, assuming a better utilization of existing units. At the same time, the construction of new plants for the production of welded and electrowelded tubes is a very urgent task.

Approximately 60% of the welded tubes produced in 1956 were manufactured in plants having a low degree of mechanization, low operating efficiency, and a high consumption coefficient of metal and fuel.

The Five-Year Plan envisages the installation of continuous furnace welding stands at the Andreev Metallurgical Works and at the Chelyabinsk Tubing Works.

In future it will be necessary to increase the production of welded pipes in the East so that the transportation of welded gas pipes from the South, now due to the specific regional distribution of pipe plants, may be eliminated.

It is necessary to raise the output of electrowelded pipes in order to provide adequate supplies for the construction of long-distance gas and oil pipelines. The electrowelding pipe plant, put into operation at the Chelyabinsk Tube Works, will be in a position to substantially increase the output of large-diameter pipes if it concentrates on specialized production. The starting of the second helical-welding plant will satisfy the demand for large diameter pipes in the current five-year period.

In order to increase the production of thin-walled oil pipes required for short-distance pipelines, it is necessary to speed up the construction of plants for the manufacture of electrowelded pipes of 102 – 529 mm diameter. The construction of such plants at the Sinarsk Tube Works has been proposed.

The reconstruction of the existing furnace-welding tube plant and the replacement of the stationary furnace-welding mills in the operating plants will increase the output of electrowelded small size gas pipes, will ease working conditions, raise the operating efficiency, and cut down specific metal consumption.

The amount of cold drawn tubes out of the total quantity of seamless tubes produced in the USSR constitutes 15.5% and in the USA – 10%. The reason for this difference is that in the USA there are continuous mills for hot rolling of seamless tubes, where tubes of up to 38 mm outside diameter and 2 mm wall thickness can be manufactured; in addition, thin-walled electrowelded tubes of small diameter are widely used in the USA.

The sixth Five-Year Plan envisages the putting into operation of a continuous tube rolling plant at the Pervouralsk New-Tube Works. It will result not only in increased production of seamless rolled tubes of small diameter, but also will make possible an increase in the productive efficiency of cold-drawing tube plants and of existing automatic plants, owing to a redistribution of the tube types – each plant specializing in certain types only.

An automatic tube mill at the Chelyabinsk Tube works is planned in connection with the development of the oil industry in Bashkiriya, Tatariya, and in the East of the USSR. This mill will produce, in addition to driving and drilling pipes, stainless, steam, and other pipes for the machine building industry.

It is necessary to construct a few special drawing plants in order to fulfil the demand for especially thin-walled and electropolished pipes. The introduction of such plants will substantially reduce the output of other thin-walled pipes, since these plants use thin-walled cold-rolled pipes for the starting material, and in view of this fact it is also necessary to construct some additional pipe drawing plants.

The 1955 output of tubular products in the USSR was approximately 50 times that of 1913, and the amount of tubular products constituted 10% of the total rolled product output.

At the present time our country is the second largest tube producer in the world.

THE UNIQUE CAMP OF SOCIALISM

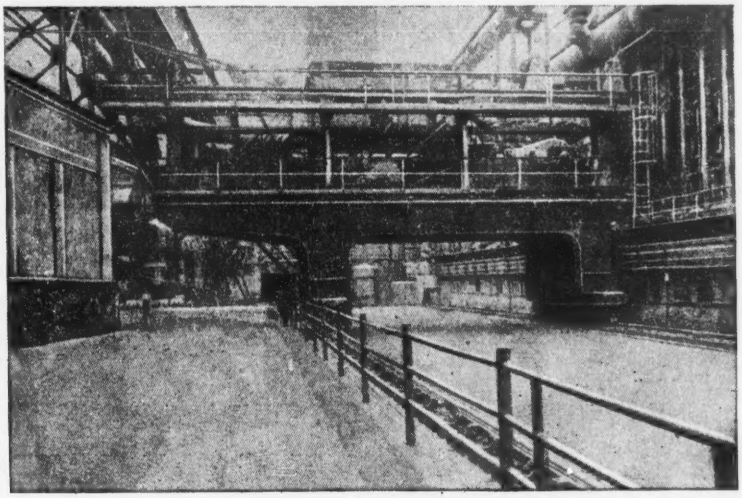
On the fortieth anniversary of the Great October when the Soviet metallurgists, who stand in the foremost ranks of the Communist society builders, record their outstanding successes, it is very interesting to take a look at the achievements of our colleagues and friends – metallurgists in the people's democratic countries. After the establishment of the democratic people's regime and the nationalization of industry, the working class of these countries began the reconstruction and development of the national economy, paying a great deal of attention to the development of ferrous metallurgy.

In the past 10 – 12 years in Czechoslovakia, Poland, Rumania, GDR (German Democratic Republic), Hungary, and Bulgaria, the ferrous industry has expanded considerably and the production of iron ore, coal and coke increased substantially.

The countries of people's democracies, having accepted the socialist way, have markedly overtaken capitalist countries in the rate of industrial growth. Thus in 1956 in the European countries of people's democracies the output of pig iron was 2.7 times, of steel – 2.5 times, of rolled product – 2.5 times, of coke – 3.6 times and of iron ore – 2.2 times that of 1938. In the same period, in all capitalist countries in Europe the output of pig iron increased to 1.5 and of steel to 1.6 times that of the respective output in 1938.

Individual countries of people's democracies are confidently outstripping capitalist countries in the ferrous industry.

Pre-war Poland produced in 1937 100,000 tons less pig iron than Italy. Now Poland produces annually 1.3 million tons of pig iron more than Italy. The German Democratic Republic as late as 1950 was still behind Sweden in pig iron output. In 1956 the output of pig iron in the GDR exceeded that of Sweden by 300,000 tons and the output of steel in the GDR exceeded Sweden's steel output by 600,000 tons. The production of steel per head of population in Czechoslovakia is higher than in such industrial countries as Italy, Sweden, and France.



Coke plant with loading cars (Czechoslovakia).

The intensified growth of ferrous metallurgy in the countries of the people's democracies is bound with the constructing and putting into operation of several large metallurgical enterprises.

In the course of the Six-Year Plan two large metallurgical combines were put into operation in Poland: the Lenin Nova Huta in Cracow and the Bierut Huta in Czestochowa. In addition, old metallurgical works — Kosciuszko, Pokoj, Florjan, and others were reconstructed. In the post-war years more than 15 blast furnaces, more than 30 open-hearth furnaces, several rolling mills, and sinter plants were erected or modernized. Powerful blooming mills were installed in several plants. A continuous sheet mill was constructed at the Lenin Metallurgical Combine.

In the course of the fulfilment of plans for the development of the national economy in Czechoslovakia, the large Klement Gottwald Metallurgical Combine in Kuncice was put into operation; it comprises two blast furnaces of over 1000 cu m working volume each, a steelmaking plant, a powerful blooming mill, a rolling mill, a tube rolling plant, and a coke by-products plant. Six blast furnaces and more than 30 open-hearth furnaces (including 16 furnaces of over 100 – ton capacity) were built or reconstructed in the metallurgical works of the country; two blooming mills and 8 rolling mills with a total annual output capacity of over 1.5 million tons of rolled material were constructed.

During the first Five-Year Plan in Germany a metallurgical plant comprising six blast furnaces of 600 cu m volume each, a sinter plant, and works TETs* was built near the Polish border. The first metallurgical plant in he world having 10 low shaft furnaces was built in the town of Kalbe. This plant is designed to use brown coal for the processing of local iron ore of low iron content. In Riese, along with the rebuilt steelmaking plant No. 1, a new modern plant equipped with open-hearth and electric furnaces grew up. A metallurgical plant with 11 open-hearth furnaces of 140-ton capacity each was built in Brandenburg. The capacity of the rolling mills of the GDR has increased in the past eight years elevenfold; a large section mill, several small section mills, a continuous wire drawing plant, and a tube mill of Stiefel type were built.

At the large metallurgical combine being built in Dunapentele in Hungary, a blast furnace, a modern open-hearth furnace plant, coke by-product and refractory plants, a TETs and a sinter plant have been put into operation. At the Dioshdyer Combine the output of rolled products increased by 50% on account of the extension of the main plants, and the output of rolled product at the Ozd Works increased by a factor of 2.8. The construction of an electric steelmaking plant and a radical modernization of rolling mills at the Borshodnadazhdi Lemezdar Works resulted in a 5-fold increase in output. The output of wire and cold rolled steel at the Shalhotaryan Works rose considerably.

As a result of the construction of new units and the modernization of old ones at the Hunedoara Metallurgical Works in Rumania, the output of pig iron in 1955 was 2.3 times that of 1950, and steel and rolled products 1.3 and 1.7 times respectively. The Reshits, Otselul Rosha, and other metallurgical plants underwent a substantial modernization. In Bulgaria, which previously had no metallurgical industry of her own, an integral iron and steel plant with a full cycle of metallurgical processes was erected and put into operation in Dimitrov. 30% of Bulgaria's requirements in ferrous products is now provided by her own industry.

The successful building of the ferrous industry in the countries of people's democracies was aided by co-operation among the socialist countries and the freely shared vast experience of the Soviet Union.

The Soviet Union gave Poland the technical documentation and supplied equipment for the Nova Huta Metallurgical Combine. The construction of the Dunapentele Metallurgical Combine in Hungary was carried out with the assistance of the Soviet Union. Soviet specialists helped the GDR (German Democratic Republic) in the repair of blast furnaces at the Stalinstadt Works, in the modernization of steelmaking plants and rolling mills, and in the mastering of alloy steels and ferroalloys production.

The Soviet Union gave Czechoslovakia technical documentation of a tube-rolling mill and the technological know-how of the production of high grade steels and ferroalloys. The prospecting of iron ore deposits in Bulgaria as well as the construction and starting of metallurgical works there were carried out with the help of Soviet experts.

In its turn the Soviet Union borrows the industrial and scientific experience of the countries of people's democracies. Soviet metallurgists make use of Poland's experience in the field of coal mining and dressing and coke production with application of ramming. Joint scientific research on low alloy steel, on the removal of arsenic from iron ores, and on other problems is being carried out.

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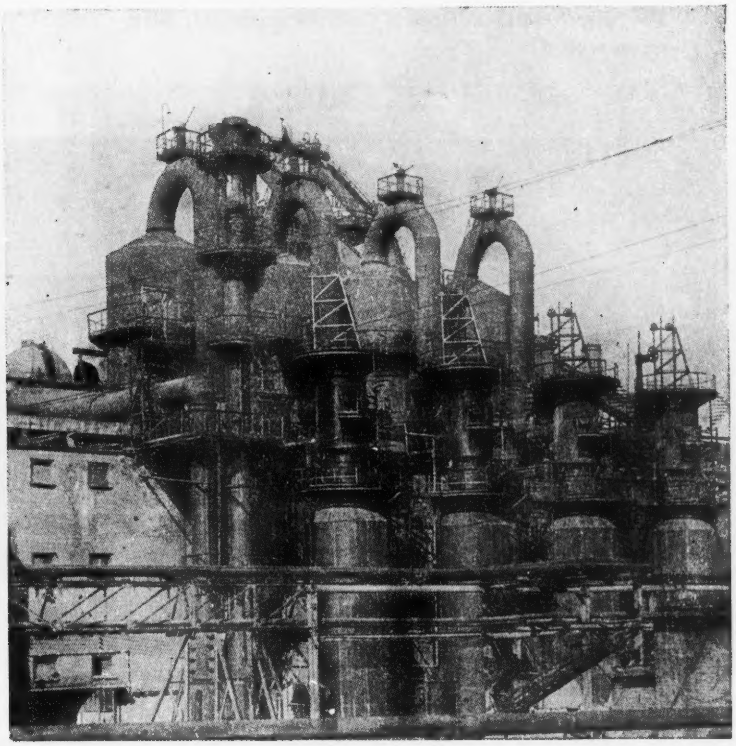
* Transliteration of Russian — Publisher's note.

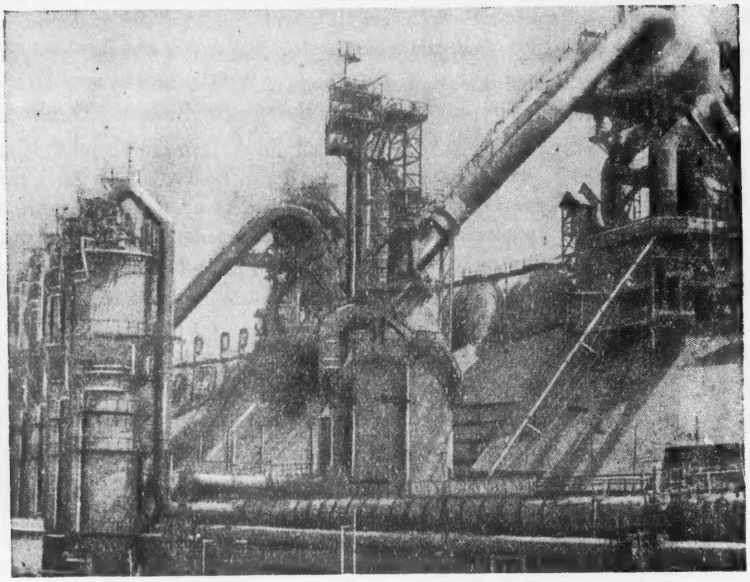
Czechoslovakia assists Poland in the manufacture of steel and rolled material. The GDR shares her experience with Chechoslovakia and other countries of people's democracies in the production of coke from brown coal. Poland and Czechoslovakia greatly assist the metallurgical industry of Hungary, the GDR, and Rumania – which suffer from shortage of coking coal with regular supplies of metallurgical coke. Over the period from 1950 – 1955, coke supplies from Poland and Czechoslovakia to those countries increased by a factor of 1.5.

In order to ensure the expansion of pig iron production in the countries of people's democracies, the Soviet Union increased the production of high grade Krivorog iron ore in 1956 to almost three times the yield of 1950. It enabled the countries not possessing rich ore deposits to reduce capital expenditure on the construction of costly mines and ore concentration plants for poor, dispersed ore deposits. The increased supplies of Krivorog ore had an effect also on an improvement in the utilization of blast furnace capacities, reduction of specific coke consumption, and cutting down of pig iron cost.

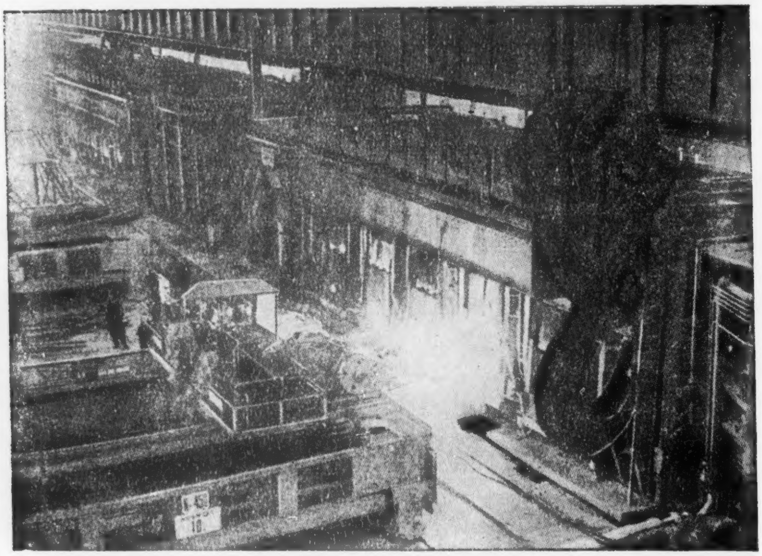
Owing to a better use of the existing machinery, radical improvement of the organization and technology of production, and the creation of a body of highly qualified specialists, the technical level of the metallurgical industry in the European countries of people's democracies rose considerably. Thus in Poland in 1956, compared with 1950, the mean volume of blast furnaces increased by 35%, the capacity of open-hearth furnaces increased by 40%, the production of agglomerate increased by more than 300%, the coefficient of blast furnace working volume utilization improved by 43%, and the output of steel per one square meter of open-hearth furnace floor increased by nearly 20%.



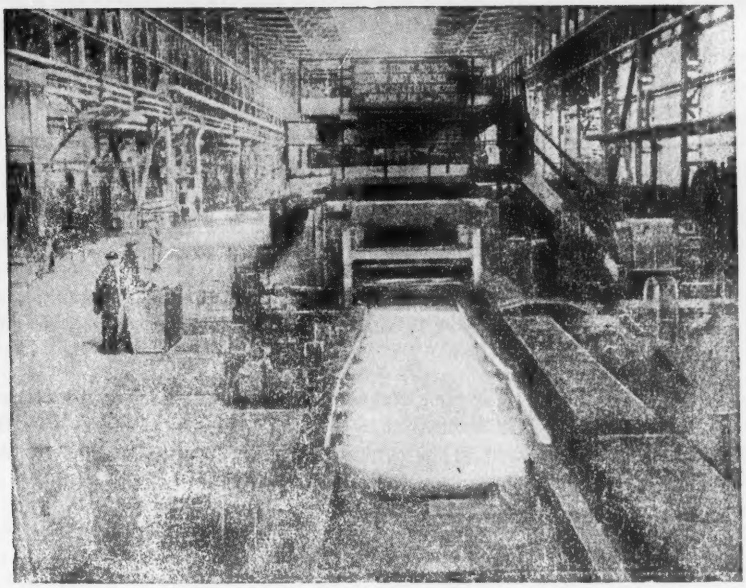
Sub-plant for gas purification at blast furnace No. 6 in the Hunedoara Works in Rumania.



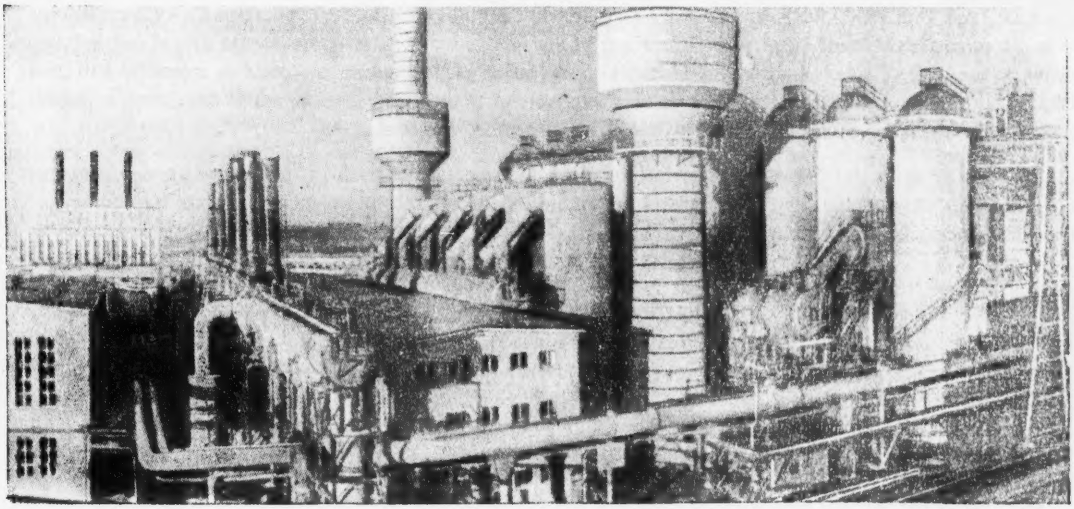
The Nova Huta Metallurgical Combine in Poland. Blast furnace plant.



The Nova Huta Metallurgical Combine in Poland. Open-hearth furnace plant.



The Nova Huta Metallurgical Combine in Poland.
Rolling Plant.



Low-shaft furnaces at the Kalbe Works (GDR).

Blast furnace operators at the Lenin Metallurgical Combine in Poland attained a coefficient of blast furnace working volume utilization of 0.83 and mean coke consumption of 809 kg/t of pig iron at 39% mean iron content in the charge, mainly by improving the preparation of charge materials for the blast furnace process, raising the blast temperature, and increasing the basicity of the agglomerate. With the putting into operation of a continuous sheet-rolling mill at this works, a fully mechanized production of thin sheet material was established.

Czechoslovakia's metallurgists have done a great deal to improve the preparation of iron ore raw material for smelting. A method of magnetization roasting of Slovak siderite ores in revolving furnaces, by means of which iron concentrates of 58 – 61% iron content with 90% yield can be obtained, has been developed. The enrichment of Czech ores has been organized (chamosites and hematites) by the method of direct reduction in revolving furnaces, the product obtained containing 85 – 88% iron: the production of agglomerate in the country increased considerably, and the installations for ore preparation are under construction. All these measures resulted in a 20% increase in the utilization of existing blast furnaces in the course of five years.

The steelmaking plant operators in Czechoslovakia considerably increased the operating efficiency of furnaces by raising thermal capacities of open-hearth furnaces, shortening hot and cold repairs of the furnaces, mechanizing labor-consuming processes, successfully applying oxygen to the intensification of the melting process, and adopting basic furnace roofs. The production efficiency of rolling plants also increased. For instance, the personnel of the semicontinuous wire mill at Trzynec Works achieved an hourly wire production of 27 tons/hr.

In the German Democratic Republic oxygen is applied at present in the converter process and electric furnaces. At the Makshutte Works, by the adoption of oxygen-enriched blast in the Thomas Converter process, the blowing time was cut by more than 30%. High output was achieved by the rolling mill operators of Riesa, who increased the output of light sections on the light section mill to 21 tons/hr.

A considerable mechanization and automation of production was carried out at metallurgical works in Rumania. The mechanization at the Hunedoara Works approached 90%; production processes and the control of thermal conditions were automated. The efficiency of the ferrous industry of Hungary and Bulgaria increased substantially owing to the adoption of new methods.

To encourage the expansion of collaboration between the countries, the SEV (Council for Mutual Economic Assistance) established, in 1956, permanent branch commissions, including the Commission for Economic, Scientific, and Technical Cooperation of SEV members in the field of ferrous metallurgy. This Commission works out plans for the most efficient development of the ferrous industry; it studies better uses of industrial capacities on the basis of specialization and industrial cooperation of the countries; considers scientific and technical problems met in ferrous metallurgy, scientific personnel of all member countries of SEV being engaged; organizes the exchange of advanced industrial experience among the countries.

A friendly participation of expert metallurgists of all the countries in the discussion of important economical, scientific, and technical problems makes it possible to find the most appropriate ways for a rapid expansion of the ferrous industry.

Engineer P. A. Pavlov

THE PROJECTS OF THE FIVE-YEAR PLANS

After the Civil War, the most urgent task to be accomplished by the Soviet people was the industrialization of the country. The young state could expect no outside assistance in building its industrial foundation; our own efforts were the only hope. And work began.

Factories were built in the wilderness, on the steppes, and on the taiga. Construction workers lived in tents and mud huts; sometimes suffering biting cold, sometimes scorching heat, they overcame enormous difficulties and erected plants, furnaces, and coke-oven batteries. One of the largest projects of those years was the Magnitogorsk Metallurgical Combine. In February 1932, the first batch of pig iron was obtained from the first blast furnace of Magnitogorsk. It was a great success for the designers, builders, and metallurgists. The Combine grew steadily. New units were put into operation – blast furnaces, open-hearth furnaces, rolling mills and turbo-generators supplying electric power to the vast plants. Now, Magnitogorsk is the largest metallurgical concern in Europe.

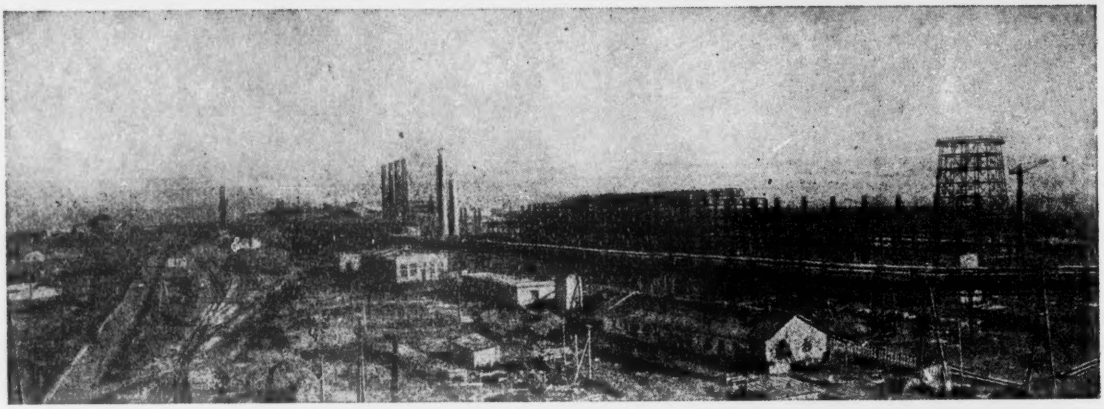
Just over two months passed and another plant started operation on the Siberian taiga. A fiery stream of metal poured from the tap hole of blast furnace No. 1 at the Kuznetsk Metallurgical Combine. Soon the second furnace followed, smoke appeared from the stacks of open-hearth furnaces, and the first rail from Kuznetsk steel came out of the rail structural mill. The Combine has now become one of the largest plants in the country.

The "Azovstal" Works was put into operation during the second Five-Year Plan. The vicinity of Krivorog and Kerch ores, Donets coal, and the ease of transport of raw materials and products by sea determined the location of the erection site and promoted a rapid expansion of the plant. During the Great Patriotic War the Hitlerites completely demolished it. After the war the Soviet people raised the plant from ruin. Now it again produces metal, the huge open-hearth furnaces are roaring, and molten steel pours into the ladles. Railroad rails bearing the "Azovstal" stamp extend across the entire country.

In 1933, a few kilometers from Dneproges, the "Zaporozhstal" Works was put into operation producing thin steel sheet, which was in very great demand by the motor car industry then being established. Soviet metallurgists completed this task with honors. The war brought devastation to the plant, turned the large mills into ruins; but constructors and fitters, by perseverance and hard work, gave new life to "Zaporozhstal." Now, the plant output exceeds the pre-war production. Zaporozhstal sheet is employed not only in the USSR but also abroad.

During the fifth Five-Year Plan in the ancient little Russian town in the Vologda province, the Cherepovets Metallurgical Works was erected. The raw materials are supplied from iron ore deposits of the Kola peninsula and coal deposits of the Pechora basin. The great day of the first pig iron batch production was a festive occasion for all Soviet metallurgists and constructors. Very soon the large open-hearth furnace plants and rolling mills will start production and Cherepovets metal will go to all parts of our land.

Prior to the Revolution Zakavkazye (Trans-Caucasus district) was essentially a farming country. The only industrial activity here was oil drilling. The huge natural resources of Dashkesan, Tkvarcheli, and Chiatury were unused. The Soviet government transformed that country. Soon after the war in the little town of Rustavi, the construction of a metallurgical plant which was to provide the developing Zakavkazye's (Transcaucasian) industry with plates and pipes began. At the present time it is already a large establishment with blast furnace and open-hearth furnace plants and the latest modern rolling mills. The plant is continually expanding and its output of metal increasing.



"Krivorozhstal" Works.

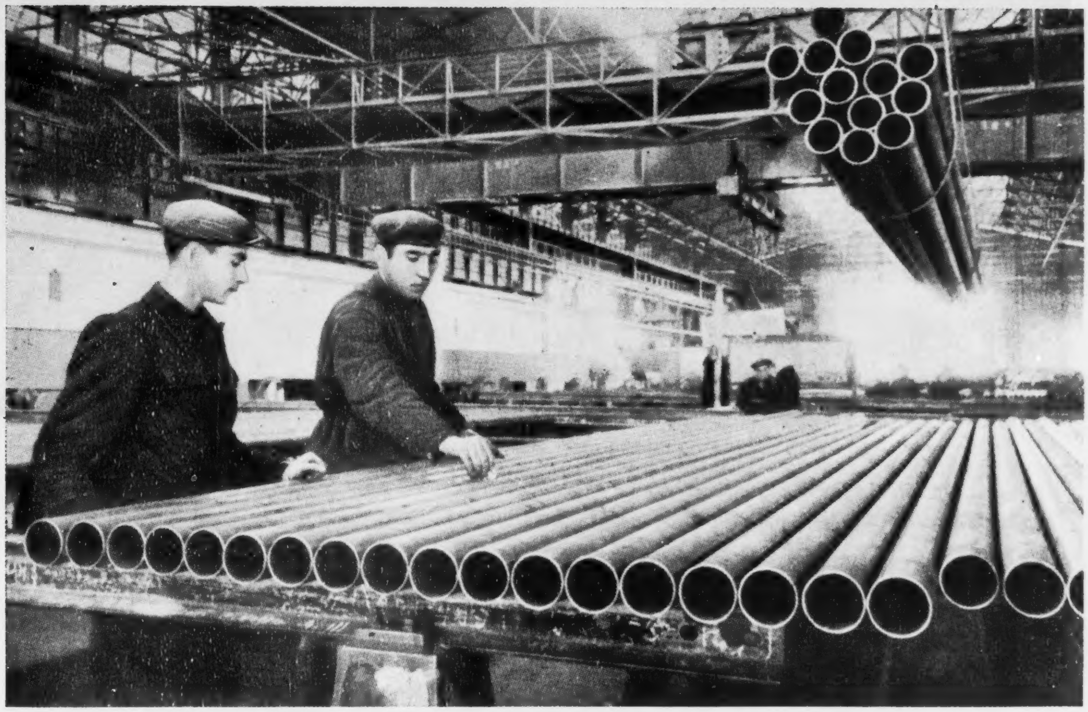
Final product in stock at the "Zaporozhstal" Works.

Wheel-rolling plant of the Nizhne-Tagil Metallurgical Combine.

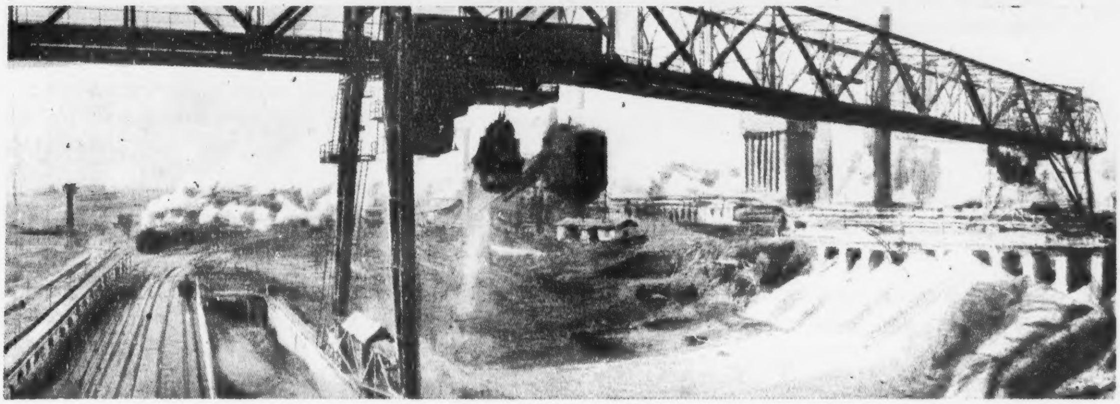
The ores of the Orsko-Khalilovsk deposits contain valuable elements: chromium and nickel. On the steppes of the Southern Urals there appeared a new plant in whose powerful units the Orsko-Khalilovsk ore is processed day and night to yield alloy steel. The glow over the converters of the Combine never goes out. The Combine, provided with modern equipment, continues to grow.

The Novo-Tagil Metallurgical Works was built near the Vysoka mountain, in the region where the metallurgical industry has been in existence for over two hundred years. The new plant, unrestricted by the framework of old ones expanded rapidly. Here the first wheel-rolling mill in the USSR, producing hundreds of thousands of wheels annually, was established.

This year the Novo-Tagil Works was merged with other establishments of the ferrous industry in Nizhne-



Final product in stock at the Bakinsk Tube Works.

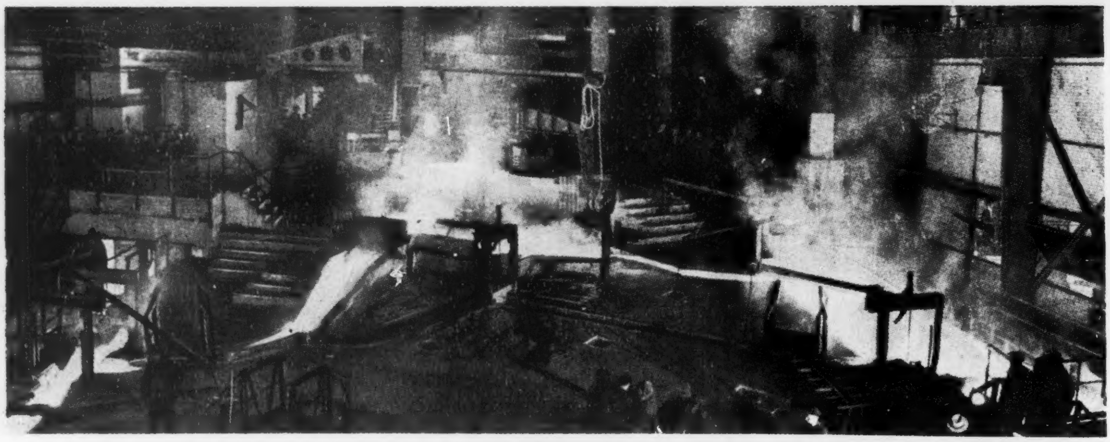


General view of the Kuznetsk Metallurgical Combine.

Tagil and it became the main-stay of the Nizhne-Tagil Metallurgical Combine which will supply the country with even more metal.

Not far from Baku a tube-rolling works, supplying the Transcaucasian oil industry with pipes, was built. Here the roughing mill was recently put into operation. Now it can be said with confidence that the Baku Works has a great future.

In the center of the Krivorog iron ore basin a new metallurgical giant – the "Krivorozhstal" Combine – is being created. So far only blast furnaces are operating, but soon the Bessemer, open-hearth, and rolling plants will start operation.



First batch of pig iron tapped from blast furnace No. 1 of the Cherepovets Works.

Enormous horizons are opening before Soviet metallurgists. Each year the steel production of our country increases.

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PAST AND PRESENT

THE LARGEST PLANT IN THE SOUTH

On the bank of the mighty Dnieper, in place of the picturesque village of Kamenskoe, there is now situated a new industrial and cultural center of the Ukraine – Dneprodzerzhinsk.

In the town there are several large plants with up-to-date equipment and about 30 factories and other establishments of local industry. The most prominent position in the industrial production of the town is held by the industrial giant – the Dzerzhinsk Metallurgical Works.

In early spring of 1887 a Commission of the Society of Warsaw Steel and Rail Works arrived in the village of Kamensko and selected the site for the erection of a large-scale metallurgical works on the right bank of the Dnieper.

The choice of the site was determined by the nearness of good waterways, railroads and the Donets coal and Krivorog iron ores.

The Warsaw Society and the Belgian company Cockerel founded the South Russian Dnieper Metallurgical Society (YuRDMO), which started the construction of the plant in 1887. The equipment for the main plant – blast-furnace, open-hearth furnace, Bessemer and coke-oven plants – was taken from the Belgian Cockerel Works; a part of the equipment was brought from the Warsaw plant.

At the same time engineers, foremen, and skilled workers were transferred to the new plant in Kamenskoe. The majority of the workers, however, were people from the neighboring villages, impoverished and ruined peasants, who flocked in great number to the erection site.

The construction of the plant was carried out very efficiently for that time, and as early as March 2, 1889, the first blast furnace was blown in. This date is considered the day of the foundation of the Dnieper Metallurgical Works.

In the same year a second blast furnace was blown in and the Bessemer, puddling, steel rolling, iron rolling iron rolling, and open-hearth plants were put into operation. The construction of the plant was, in the main, completed in 1904.

In 1913, the plant attained the peak of its growth. It had 5 blast furnaces, 10 open-hearth furnaces, a Bessemer plant with three converters, rail-structural, iron-rolling, medium-section, wire-, sheet-, axle, and tire-rolling mills.

The output (in tons) in 1890 and 1913 was:

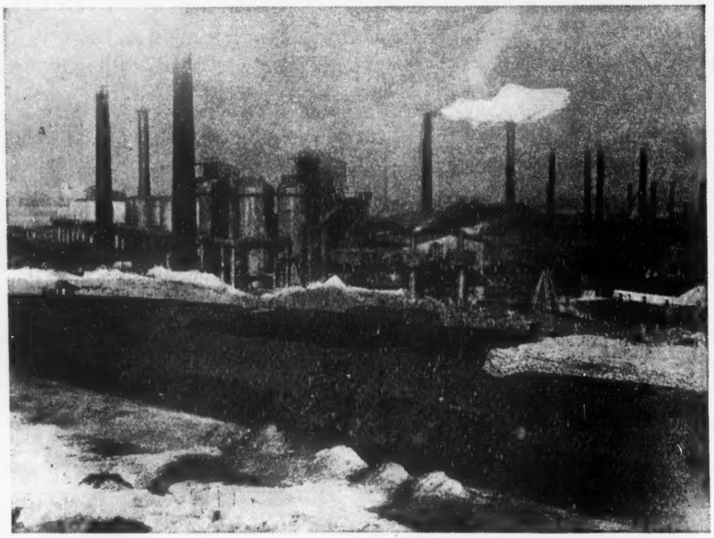
	Year	
	1890	1913
Pig iron	56,268	499,431
Steel	37,534	368,034
Rolled product	41,485	299,155

In 1913 – 1917, the Dnieper Works was the leader among the ten southern metallurgical works in Russia, in the amount of output as well as in technical equipment, although it was considerably below the standard of advanced plants abroad.

Relying on cheap labor, the capitalists did not care about mechanization, and in nearly all heavy, labor-consuming operations manual labor was predominant. According to the published records, the dividends of the shareholders of YuRDMO approached 40%. Net profit amounted to more than 4 million rubles in 1897. Cruel exploitation aroused indignation among the workers at the plant. Bolshevik-revolutionary I.V. Babushkin writes in his memoirs about the first organizations and actions of the Dnieper workers against their employers in 1897 – 1900. Together with the working class of the whole of Russia, the Dnieper workers took active part in the first Russian revolution of 1905. On February 3 a general strike was organized and an increase in wages was demanded; in May a mass meeting was organized; on June 11, workers of the mechanical and mold plants went on strike; on June 23, 6,500 workers were on strike.

At the time of the December armed revolt, Bolsheviks of the Dnieper Works organized a fighting strike committee, which on December 13, 1905, decided to join the general All-Russia political strike and demanded an immediate convocation of the Constituent Assembly.

After the lull during the years of reaction, the struggle of the Dnieper workers broke out with a new force during the First World War.



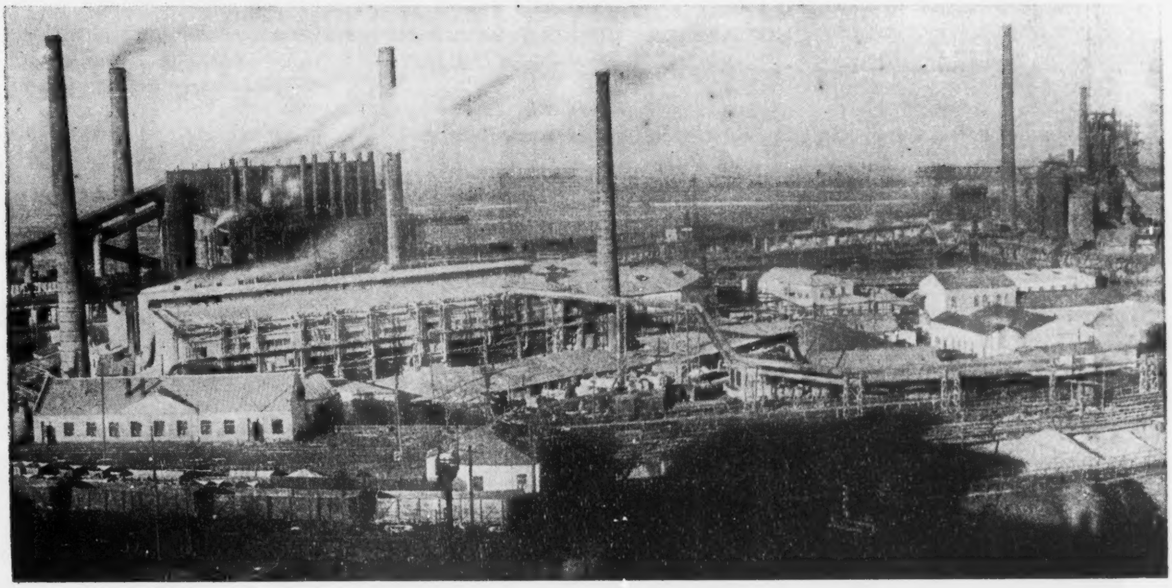
General view of the Dnieper Works in 1908.

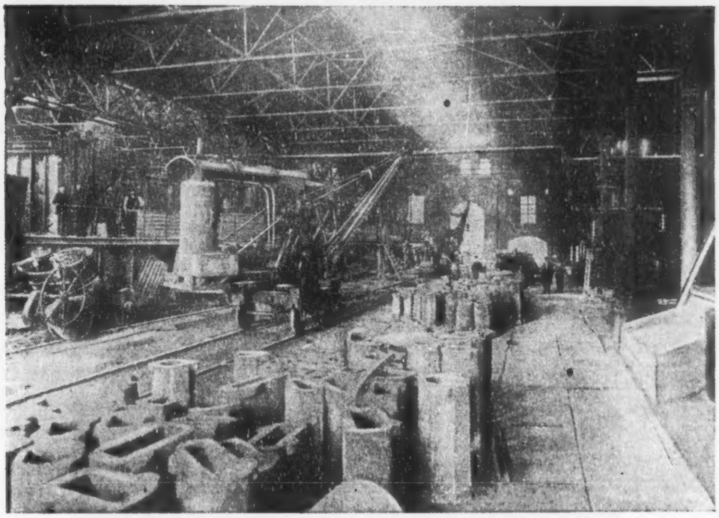
In July, 1915, 3,200 workers took part in the strikes organized by Bolsheviks for the purpose of obtaining a raise in wages; on January 10, 1916, 6,900 workers were on strike and on April 1 of the same year 7,000 workers were on strike. The plant management, in the course of fighting the strikers, set the non-striking workers against the rebellious forces. But the wave of protest did not calm down. The last strike lasted 22 days, and work was resumed only after the administration satisfied the demands of the workers.

In 1917, after the February Revolution, the Soviet of Working People's Deputies consisted predominently of Mensheviks. However, in defiance of the Menshevist Soviets, the Dnieper workers introduced, as a fait accompli, an eight-hour day as early as April of that year.

After the return of the Bolsheviks from exile and from the armed forces to the plant, the balance of political forces in the town changed radically. Trade union organizations, hospital funds and then also the Soviet of Working People's Deputies were taken over by the Bolsheviks.

In September, 1917, the Bolsheviks organized an armed worker brigade and in November, after the October Socialist Revolution, they established a Revolutionary War Committee and organized the first detachment of the Workers' Red Guard of 3,000 men. In March, 1918, this detachment fought bravely against the German



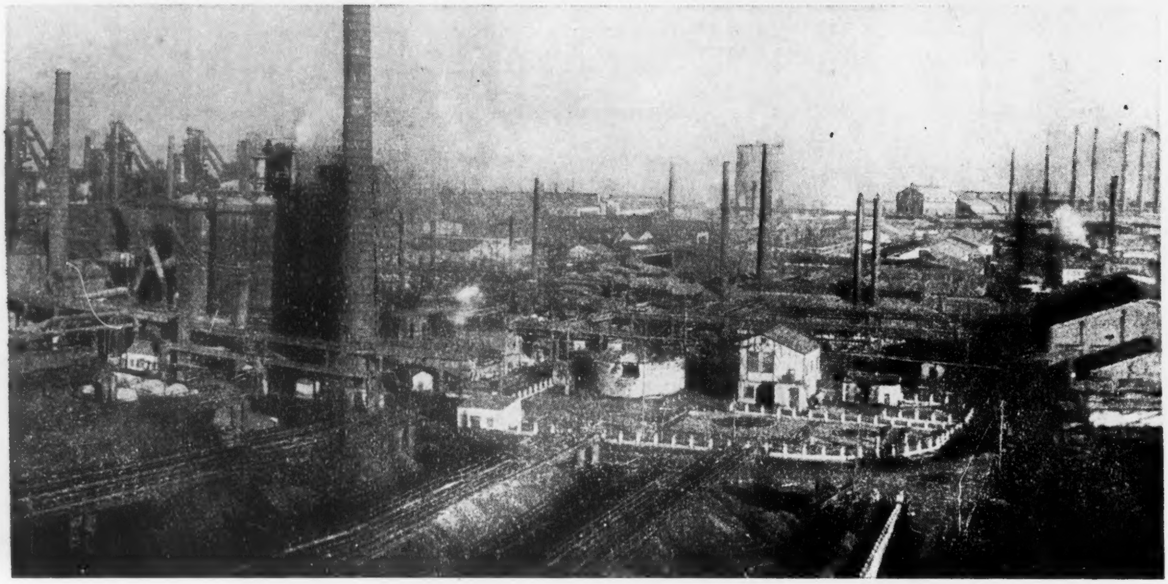


Open-hearth furnace workshop at the Dnieper Works (1908).

invaders in the districts of Znamenka and Pyatikhatki.

By their own efforts the workers of the plant built two armored trains for the fight against Denikin's White Guard bands.

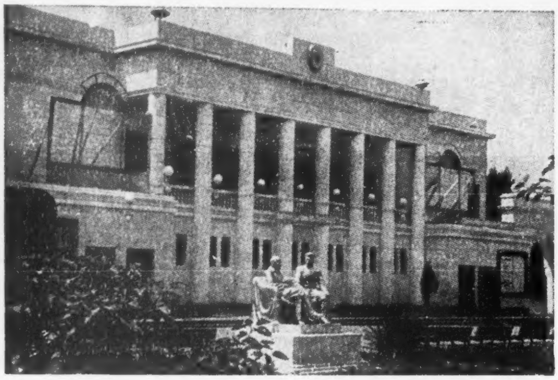
The severe years of the imperialist war, German occupation, Hetmanate, the fight against the white bandits of Denikin, Wrangel, and Petlura and against Makhno finally undermined the industry of the Ukraine.



In 1918 production at the Dnieper Metallurgical Works ceased and the majority of workers joined the Red Army.

From 1921 onwards, after the defeat of the White Guard and the anarchist bands of Makhno, the development of the national economy began, priority being given to the reconstruction of industry.

The workers of the Dnieper Works having returned from the army, set about preparing the machinery, idle for many years, for resumption of activity. The chairman of VSNKh, Feliks Edmundo * works, assisted greatly in the reconstruction of the plant.



The Palace of Culture of the Metallurgists in Dneprodzerzhinsk.

* As in original — Publisher's note.

April 25, 1925 – the day of starting the first blast furnace – is regarded as the date of the rebirth of the plant. By 1926, the reconstruction of the plant was practically completed: 4 blast furnaces and 9 open-hearth furnaces were already in operation and so were a Bessemer plant, rail-structural, iron-rolling, medium-section, wire-, sheet-rolling, and axle-and-tire-roling mills.

During the years of the country's industrialization, new plants and units with first class equipment were built at the mill: a new sinter plant with two sinter chains, two blast furnaces of 930 cu m volume with bunker scaffolding and full mechanization of labor-consuming operations, an open-hearth furnace plant containing furnaces of 50 sq m hearth area each, a new blooming mill, and a universal mill. The power plant of the plant and maintenance and auxiliary shops were expanded. In the old plants the most labor consuming processes were mechanized.

Below are given the production data of the plant in these years (1913 is taken as 100%):

	Years			
	1932	1937	1940	1941 (Planned)
Output, %:				
pig iron	155.3	273.0	303.0	368.0
steel	118.3	334.0	319.0	388.4
rolled product	123.6	343.8	343.0	456.0
Total output, %	154.8	345.0	376.0	496.8
Coefficient of working volume utilization.	1.64	1.14	1.12	0.87
Steel output per 1 sq m of furnace hearth per 24 hrs, ton	1.77	4.41	4.77	5.61
Rolled product output, t/hr	111.1	236.9	218.5	240.4
Operating efficiency, %	79.0	155.0	225.3	251.0
Rise in wages, %	334.0	683.0	870.0	1047.0

In the course of the pre-war Five Year Plans, hundreds of well-planned houses and hostels, a palace of culture, clubs, libraries, sports halls and stadiums were built.

In 1934 on the initiative of the employees of the plant and the petition of the town inhabitants, Kamenskoe was renamed Dneprodzerzhynsk.

The treacherous aggression of fascist Germany on our homeland interrupted the peaceful work of plant personnel. In August, 1941, our forces left the town. For more than two years the aggressor played the master of the plant and tried to put it into operation. The Soviet people, while risking their lives, used all means to prevent it. Only after 554 days, did the Germans manage with the greatest of effort to obtain product from the smallest thin sheet mill, and after 630 days – steel from one open-hearth furnace. They did not, however, succeed in putting the blast furnaces into operation.

Before retreating, the German aggressors ruined the plant; particularly great damage was done to the new, most modernly equipped mills. Open-hearth furnace plant No. 3, the new blooming mill, all the blast furnaces, the rail-structural plant, the steam-and-air-blowing station, and other units were completely demolished. The total cost of damage done by the aggressors amounted to about one billion rubles.

SIGNIFICANT DATES

1946

MARCH. The Supreme Soviet of the USSR passed the Law on the Five-Year Plan for the Reconstruction and Development of the National Economy of the USSR in 1946 – 1950.

SEPTEMBER. Blast furnace No. 4 at the "Azovstal" Works was restored.

1947

OCTOBER. The first part of the reconstruction of the "Zaporozhstal" Works was completed. Automation of the rolling mill at the Magnitogorsk Metallurgical Combine was carried out.

DECEMBER. A blast furnace equipped for operation with oxygen-enriched blast was put into operation at the Novo-Tula Metallurgical Works.

On October 21, 1943, the towns of Dnepropetrovsk and Dneprodzerzhynsk were liberated. The administrative staff of the plant returned with units of the Red Army and set about restoring production.

The Dneprodzerzhynsk people flocked to their home plant from all over the country. Workers, foremen, engineers, technicians, and other employees began the restoration of their plant under extremely difficult conditions.

By their heroic efforts the personnel of the plant succeeded in reconstructing mills in a short time. Only 26 days after the Germans were driven away, steel was obtained from open-hearth furnace No. 5 On the 49th day, the sheet-rolling mill was put into operation and the first tons of the product were given to the country. Pig iron was obtained on the first anniversary of the town's liberation.

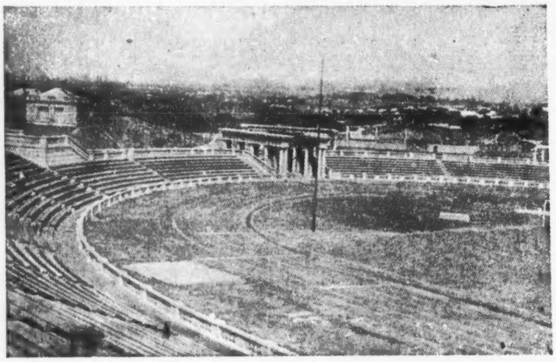
By 1950, the plant was completely restored; at the same time a great deal was done regarding the modernization of equipment, alteration of operational schemes, and mechanization of labor consuming processes. In place of the demolished Bessemer, rail-structural and wire-drawing plants, new plants were built in which recent technical advances were taken into account.

In 1948 4 blast furnaces were working: Nos. 1, 6, 7, and 8. Because of extensive damage it was not expedient to reconstruct the fifth and the third furnaces. In their place the erection of a new, large, fully mechanized blast furnace began; other large-capacity blast furnaces followed, the latest having been built in record time – 6 months.

At present the blast furnace plant in Dneprodzerzhynsk is the greatest in pig iron output in the Ukraine and the second greatest in the USSR (after Magnitogorsk).

Simultaneously with the construction of blast furnaces, the restoration and building of the sinter plant was carried out; the sinter plant now has six sinter chains. The iron ore yard and bunker scaffolding were extended.

In 1955 another open-hearth furnace was put into operation. At present the share of the Dneprodzerzhinsk Works in the steel production of the USSR is considerable.



The "Pobeda" Stadium.

The building of a plant for the production of technical oxygen, which will be supplied to one of the open-hearth furnace plants at the end of this year, is now about to be completed. It will allow an increase in the steel output by 10 – 15 %.

An enormous task was carried out in the erection and reconstruction of the rolling mills.

In 1953 a new 1150 blooming mill was put into operation, and in 1957 a modern tube-making plant in accordance with the last word of technology. Thus at present the following rolling mills are in operation at the plant: a 1150 blooming mill, a continous tube plant, a rail-structural mill with a 950 blooming mill and with a billet stand, a universal plant, an iron-rolling, a medium-section and a sheet-rolling mill . The mills produce very varied shapes from the grooved pile type L-V of 100 kg per m length to the angle iron 20 x 20 – 4 mm and the wire rod of 6.5 mm diameter.

SIGNIFICANT DATES

1948

DECEMBER. The first all-welded blast furnace in the USSR was put into operation at the "Zaporozhstal" Works.

1949

JULY. The large "Olenegorsk" mine was opened in Monche-tundra to serve as the iron ore base of the Cherepovets Metallurgical Works.

DECEMBER. Blast furnace No. 1 at the Zaporozhstal Works was rebuilt.

1950

DECEMBER. Blast furnace No. 1 at the Novo-Lipetsk Works was put into operation after being reconstructed.

1951

OCTOBER. Blast furnace No. 1 at the "Svobodnyi Sokol" Works was put into operation.

In the process of the construction and operation of the mills,the personnel of the plant during the post-war years continually introduced new methods and advanced technology. In the blast furnace plant, for the first time at our plant, the method of blast furnace operation control by the analysis of peripheral gases was developed and adopted.

All furnaces are operated at an increased gas pressure, the humidification of the blast with automatically controlled humidity and a high blast temperature being widely applied.

The blast furnaces work with sintered agglomerate. For the first time at our plant iron-manganese sinter was produced, thus eliminating the necessity of charging raw manganese ore into the furnace; small additions of lime for the intensification of the process of sintering the ore are introduced; in this way the operating efficiency of sintering plants increased by 5 – 10%.

At present the blast furnace operators together with scientists are working on the problem of the full automation of the blast furnace process control (by means of a charging method as well as blast and temperature conditions in the furnace). Work on the internal desulfurization of pig iron by means of magnesium is being carried out and this method should, under favorable conditions, radically change the whole technology of the process.

In the open-hearth furnace plants, all furnaces have magnesite-chromite roofs; compressed air is employed; and for the first time in the metallurgical practice, new ports have been developed that ensure the supply of air and oxygen to the open-hearth furnace.

In the Bessemer plant a new technology of rail metal production has been adopted and for the first time in the USSR a device for the automatic control of the blowing process of molten metal was introduced. Liquid Bessemer steel is degassed in this plant.

Preparations are being made at the plant for the use of oxygen in open-hearth furnaces and Bessemer converters; methods of refining hot metal in ladles or in rotary furnaces are worked out, etc.

Below are given the data on the utilization of the capacities of the equipment in the post-war years:

Year	Working volume utilization coefficient	Output per 1 sq m of furnace floor,ton
1950	0.85	5.87
1956	0.78	6.38

At present the personnel of the Dzerzhynsk Works produce the cheapest pig iron, steel, and rolled product of all the metallurgical works of the ferrous industry in the USSR.

In the 40 years of the Soviet regime, highly qualified specialists capable of solving any production problem have grown up at the plant. The overwhelming majority of leaders at the plant are former workers who went through evening courses at the Metallurgical Institute without interrupting their work and acquired extensive industrial experience directly at the working place.

The personnel, while systematically raising the the level of their technical knowledge, show great activity in the field of invention and innovation at the plant. In five years (1950 – 1955) alone, 5878 innovations and technical improvements were introduced at the plant; the result was a saving of 63 million rubles.

In the All-Union competition for the first quarter of 1957, the title OutstandingForeman of the Blast Furnace Plants of the USSR was earned by foreman D. F. Kotsar and the tile Outstanding Foreman of the Steelmaking Plants of the USSR by the foreman of plant No. 3, A. T. Kitaev. The title of outstanding team was earned by the team of senior furnace attendant I. Z. Susid, the open-hearth furnace team led by A. S. Semenov, and the team of operators of the universal mill under G. D. Kovtun.

In the post-war years 258 well-planned houses with 110,981 sq m floor space were built for the workers. The total residential area at the plant comprises 240,000 sq m,which is 15 times as much space as in 1913. At present extensive projects on heating facilities and the gas installations are being carried out in the town.

In 1956 alone, 3,425 people went to health resorts,sanatoria, and rest homes.

There are 32 secondary schools in the town, 9 schools for working youths, 6 schools of labor reserves, one evening institute for metallurgy, 2 technical schools, and a school for midwives and surgeon's assistants (secondary schools and the schools of labor reserves are attended by about 30,000 people), 28 kindergartens, 7 pioneer camps, 10 excellently equipped hospitals, 12 poly-clinics, a dispensary, a TB-sanatorium, two palaces of culture, 13 clubs, regional mobile theatre, two cinemas, three stadiums, 27 libraries,etc.

The personnel of the Dzerzhinsk Works is marching confidently toward new industrial achievements and fighting for the foremost place in the socialist competition.

A. A. Sorokin
Head of the Technical Department

ON THE ROAD OF TECHNICAL PROGRESS

In 1723 on the bank of the Iset river where it joins the Chusova river, General V.I. Gennin, sent by Peter I to the Urals, built a fortress town and a plant – Ekaterinburg. In the spring of 1725 the same general built another dam "up the river Iset, 2 versts and 365 sashens from Ekaterinburg for "the maintenance of water reserves for Ekaterinburg's plants." At the newly built dam a new plant was constructed in 1726 for "the increase of iron, employing 6 hammers."

The first products from the plant were obtained on November 8 (19), 1726. In the first year only 12 tons of pig iron were produced. In 1727 the plant was considerably expanded and the number of hammers was increased to nine with three smelting forges in operation. Output rose to 306.5 tons. 147 workers were employed at the plant. Two blast furnaces were built in 1736.

Russia, at that time frequently engaged in war, required large quantities of metal. These circumstances were conducive to a fairly rapid development of all the Urals plants of that time and, in particular, of the Verkh-Iset Works.

In the newly built plant Ural serfs from neighboring settlements – a gratis labor force subjected to brutal exploitation – were mainly employed.

Until 1758 the Verkh-Iset Works was under State management and then along with 6,000 serfs, it became the property of Count Vorontsov.

The plant continued to expand. In 1761 there were 16 hammers and one rolling mill in operation. The output of rolled plate in this year was 797 tons and there were 398 workers. Vorontsov, however, proved to be a bad manager and the plant began to decline. It was bought in 1774 by a wealthy St. Petersburg merchant, Savva Yakovlev. He and his successors owned the plant until 1908. During this period its output increased considerably. The number of workers rose to 616 in 1775. Two new mills were built at the plant in 1800: a sheet-rolling and a sheet-forging mill for the manufacture of roof-iron sheeting.

The quality of the products improved because of the introduction of much better (even compared with foreign) methods of production.

The so-called "Yakovlev" light sheet iron stamped "A.Ya. Sibir" was world famous and was exported to many countries, including the U.S.A. There are cases recorded when this iron retained its original properties after a hundred years service.

In 1863 a machine plant manufacturing various kinds of equipment for the metallurgical and gold-mining industries – such as locomobiles, boilers, steam engines etc – was built at the plant.

In 1865 the power supply of the plant was modernized: water wheels were replaced by a steam turbine by which the air-blower, two rolling mills and other units were driven. Together with the expansion of the plant and all industry of Ekaterinburg, the working class and its revolutionary consciousness developed. At the end of the 19th century a Marxist circle was organized at the Verkh-Iset Works, and from the beginning of the 20th century the plant became one of the centers of the Bolshevist underground movement in the Urals.

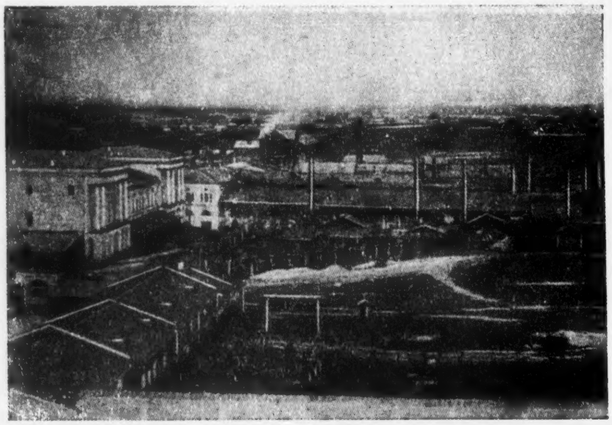
1952

JUNE. All-welded blast furnace No. 5, constructed by means of the most modern methods of automatic welding, developed by the Paton Institute, was put into operation at the "Zaporozhstal" Works.

DECEMBER. An oxygen plant producing industrial oxygen for the intensification of metallurgical processes was put into operation at the "Zaporozhstal" Works.

The first heat in open-hearth furnace No. 6 of the "Zaporozhstal" Works with the application of oxygen for the intensification of combustion was carried out.

The plant continued to grow. In 1907 the following units were in operation: blast furnace, puddling and heating plant (five furnaces and three hammers), open-hearth furnace plant (two furnaces of 8 ton and 12 ton capacity respectively, with an annual output of 11,600 ton), sheet-rolling plant (two mills and four water-driven hammers with an annual output of 5,000 tons of thin sheet and 670 tons of boiler plate. 835 men were employed at the plant.



Administration building and sheet-rolling plant
of the Verkh-Iset Works (end of the 19th century).

The joint-stock company, controlled by the Azov and Don Commercial Bank, became the owner of the Verkh-Iset Works in 1908. At the beginning of the First World War the plant produced only thin sheet iron. The blast furnace was demolished.

The Revolution of 1905 stirred the Ural workers to the fight for freedom and the overthrow of the Tsarist règime. On May 8, 1905, the workers of the Verkh-Iset Works took part in the general strike of Ekaterinburg's industrial establishments. Ya.M. Sverdlov, who had arrived in Ekaterinburg in October, 1905, established contact with the workers and explained to them the decision of the 3rd Congress of the Party regarding the preparation for an armed insurrection.

The revolutionary headquarters, where the meeting of the Ekaterinburg Committee of the RSDRP (Russian Socialist Democràtic Revolutionary Party) took place under the leadership of Ya.M. Sverdlov were in the plant settlement. Armed groups for the fight against the Black-Hundred and pogrom-makers were organized at the plant. Arms for the fighting teams were secretly made in the mills of the plant. The workers were given military training. A Party school, established on Sverdlov's initiative, began to function in Ekaterinburg in which a large group of workers studied the history of the revolutionary movement and the tactics of the Party.

After the supression of the armed insurrection in 1905, a wave of repression rolled over the towns of Urals. Sverdlov was arrested in Perm and imprisoned.

However, the Bolsheviks of the Verkh-Iset Works continued, underground, to carry out their activities among the workers. The Bolshevist organization was headed by the following workers: Mokeev, the three Livadny brothers, and Ermakov. A Bolshevik propagandist, Vainer, frequently spoke to the workers.

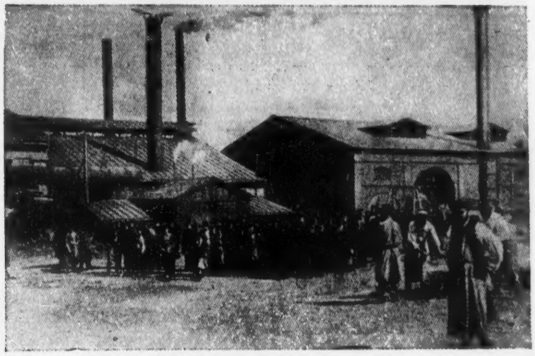
In 1913 the plant reached its maximum output: 34,389 tons of steel and 23,710 tons of finished sheet iron.

When the First World War began, the production was appreciably reduced. About 700 workers left for the army.

During the February Revolution, there was a strong Bolshevik nucleus at the plant. 15 Verkh-Iset workers were in the Ekaterinburg Soviet of Working People's Deputies.

In October, 1917, a general meeting of the RSDRP (b) (Russian Socialist Democratic Revolutionary Party (of Bolsheviks)) requested the Town and Regional Ekaterinburg Soviets of Workers' and Soldiers' Deputies to arm workers without delay and to begin the organization and training of the Red Guard. The Bolshevik Ermakov was appointed the head of the Red Guard members of the Verkh-Iset Works. This detachment was the largest and the most reliable in the town.

The Works' Red Guard units took an active part in the defeat of the counter-revolutionary bands of ataman Dutov. At that time the last RussianTsar, Nikolai II, was brought to Ekaterinburg with his family; Verkh-Iset workers were assigned the duty of guarding the Tsar. On the night of July 16, the Tsar and his family were put to death.



Strike of workers in 1905.

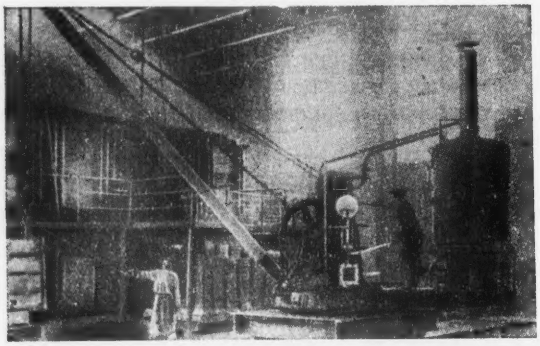
For two more years the fighters who joined the Red Army fought against the enemies of the Revolution: Kolchak, Denikin, Vrangel and others. Finally, at the end of 1919, those of the Verkh-Iset workers who were still alive began to return home.

The plant resembled a cemetery: part of the equipment had been removed by Kolchak's men and the rest was left in ruins.

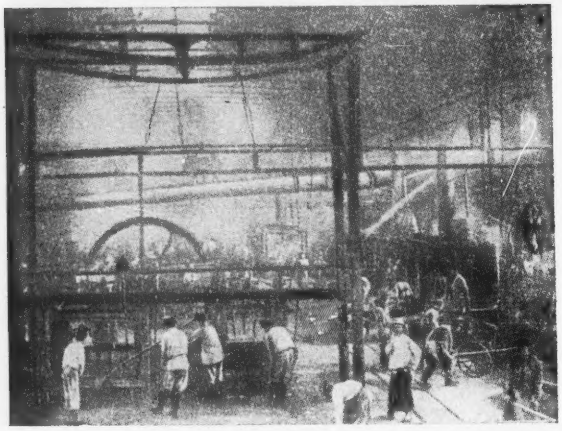
The Communists, having returned from the front, were joined by the remaining workers in the reconstruction of the plant. There were no raw materials, no fuel. Because of the lack of transport the workers delivered timber to the plant by hand and searched everywhere for scrap iron, in an attempt to start work by any means possible. The construction of the narrow-gauge railroad which was to reach the peat-bog was begun. The entire population of the settlement – from the children to the aged – joined in its construction. In two weeks 4 km of the road was laid, an old abandoned monkey-engine was found, and thus the problem of fuel delivery was solved for the time being.

In 1921 the plant was accorded the rating of a 3rd class establishment. This was almost equivalent to a temporary closing down. The workers began to disperse. The plant was being converted into workshops where, as a private enterprise, cigarette lighters and home equipment were manufactured. In order to save the plant, the Verkh-Iset Bolsheviks took it on lease, such transaction being allowed under the existing law. In the group of "leaseholders" were; Bolshevist worker Davidov, director; Sobolevsky, technical manager; and others. One half of the future returns was to be paid out in wages to the workers, and the other half was to be used for the improvement of the plant.

Workers enthusiastically began the reconstruction of the plant. By 1922 the Verkh-Iset workers overtook many other establishments in their speed of plant restoration. As a result the plant was allowed supplies as if it were a state establishment and was provided with fuel and pig iron; a 15-ton open-hearth furnace was put into operation and another was being prepared. Experienced and class-conscious workers who had left the plant earlier began to come back.



Tapping spout in the open-hearth furnace plant (end of the 19th century).



Heavy section plant (1908).

In the fiscal year 1922 – 1923 the plant produced 10,323 tons of thin-sheet iron; in 1923 – 1924, it produced 13,784 tons. In the fiscal year 1924 – 1925 33,063 tons of metal was processed including 18,781 tons of thin-sheet iron.

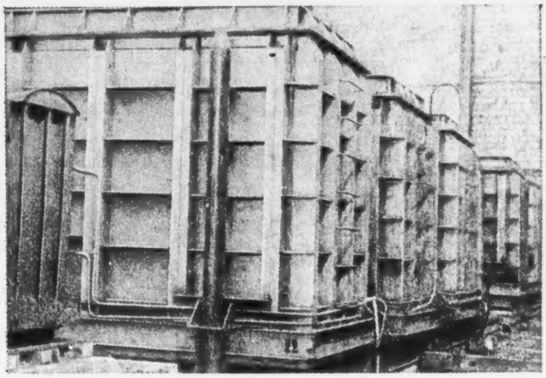
At the beginning of the first Five-Year Plan, 13 mills were operating at the plant, of which six were main ones (open-hearth furnace plant, billet mill, sheet mill, flatting mill, grading plant and dynamo iron plant). In addition to the thin-sheet roofing iron, dynamo iron and pickled iron was produced. The manufact-

ure of transformer steel began to be introduced.

More than 11 million rubles was spent during the first Five-Year Plan on the reconstruction of the Plant. The Verkh-Iset workers mastered the making of transformer steel. In 1929 manufacture of this steel in an electric furnace was begun, and on April 26, 1931, the first batch of transformer steel from an open-hearth furnace in the USSR was obtained from furnace No. 3. Until then transformer steel had been imported from abroad. In 1930 4,158 tons and in 1931 8,418 tons of transformer steel was produced. The output of roofing iron gradually declined; in 1932 it constituted only 15% of the total production of the plant.

Transformer steel is used in the manufacture of electric machinery – transformers, generators, electric motors, various electric appliances, radio, and telephone equipment etc. It should be characterized by low specific power losses (watt losses). This property is essential in the manufacture of economic and small-size electric machines.

During the second Five-Year Plan a campaign was instigated to improve the quality of electrotechnical steel and to reduce power losses.



Electric vacuum furnace for the annealing of electrotechnical steel.

During the Great Patriotic War the Plant was assigned the task of mastering, in the shortest time possible, the production of new high-grade sheet steel – stainless, aircraft chromium, chromium-nickel, carbon steel for special duties, and other steels. The task was difficult; the personnel, which had specialized for more than 10 years in the manufacture of electrotechnical steel, had no experience in the production of such special steels. Nevertheless, the problem was successfully solved. The plant was rewarded with the order of the Red Banner of Labor in April, 1944.

The plant continued to develop during the years of the post-war Five-Year Plan. The personnel of the plant achieved a considerable increase in output and an improvement in the quality on account of the intensification of metallurgical processes without the introduction of new units. Mean specific losses for transformer steel in 1950 constituted 1.41 watt/kg for 0.5 mm sheet and 1.23 watt/kg for 0.35 mm sheet.

The drive to improve the quality of electrotechnical steel continued during the fifth Five-Year Plan. Additional crane equipment was installed, the sheet bar mill was modernized, mechanized, and provided with a powerful electric motor, and the doubling section in the rolling mill was mechanized. After 1952 the open-hearth furnace roofs were lined with basic chrome-magnesite and subsequently with magnesite-chromite brick.

The power losses for electro-steel sheet of 0.5 mm were reduced to 1.36 watt/kg and for the 0.35 mm sheet – to 1.2 watt/kg; for the 0.5 mm sheet open-hearth furnace steel they were reduced to 1.44 watt/kg.

New techniques are extensively applied at the plant. An apparatus for steel evacuation (degasification) is in operation. A furnace for annealing of electric sheet steel under vacuum at 1090 – 1120°C was put into operation.

But the results achieved do not satisfy either the Verkh-Iset workers themselves or the electrical industry. The campaign to reduce power losses continues. Soon a decision is to be taken on the question of a radical reconstruction of the plant, aimed at an increased operating efficiency of the units and an improvement in the quality of electrotechnical steel. A change-over to continuous steel casting in the open-hearth furnace plant is envisaged for the sixth Five-Year Plan. An oxygen plant will be built, allowing the use of oxygen for the intensification of open-hearth furnace process.

Before 1960 it is intended to install a mill for continous hot coil rolling which will roll open-hearth ingots into sheets 1.6 – 2.0 mm thick (in coil). Later a mill will be installed for the continuous cold coil rolling, where this sheet will be rolled down to the required thickness.

A characteristic feature in the development of the plant is the extensive technical educational facilities for workers and technical personnel.

Courses for supplementary trade training, industrial courses, FZU* schools, day shift technical school, and a branch of the institute all functioned at the plant at the same time. Everybody studied – from the head of the plant to the young beginning worker. In 1956 1,666 men went through the trade training groups; 340 youths attended schools for young working people. The technical school had 52, and the institutes 55 students.

Many employees advanced from operative to responsible positions. Thus an operator at the sheet-rolling plant, Stepan Artemevich Tserikh, after attending the FZU school in 1932, worked as a rolling mill operator, a shift foreman, and then a senior foreman. In 1952 he completed a technical school course without interrupting his work. Since 1946 S.A. Tserikh has been the deputy head of plant No. 2. Alexandr Mikhailovich Shchipanov, after attending the FZU school, began work as a fitter at the Verkh-Iset Works, then became in turn a foreman, a shift foreman-mechanician, and mechanician of the open-hearth plant. In 1955 he completed a course at the Ural technical school and since that time has worked as the deputy head of the equipment workshop. There are scores of such people. This provides the guarantee that the team of Verkh-Iset workers will fulfill with credit the tasks required by the country.

F. I. Strigunkov

Technical Department

* Industrial training school.

THE STALINO METALLURGICAL WORKS

One of the largest metallurgical works of the Donbass region – the Stalino* Works – was founded by an Englishman – G. Hughes. The first pig iron was produced there in 1872.

The plant was built in the south of the Ukraine because of the presence of large deposits of coal and brown iron ore in that region. Later on when the Ekaterinburg railroad was built, the plant was supplied with ore from Krivorog.

The concentration, in a fairly small region, of the basic materials for iron and steelmaking – fuel, ore and limestone – was conducive to a fast (for that time) development of the plant.

The construction and development of the Yuzovka Works was carried out successfully also because of cheap labor – ruthlessly exploited Russian and Ukrainian workers who were employed only on heavy manual jobs. An overwhelming majority of the administration and of the technical personnel were foreigners.

By 1910 there were 7 blast furnaces, with daily output varying from 100 to 300 tons operating at the Yuzovka Works. Initially for the manufacture of iron 15 puddling furnaces were erected, which were later replaced by open-hearth furnaces and Bessemer converters. In 1910 the plant contained 10 open-hearth furnaces of up to 30-ton capacity with a total daily output of about 580 tons. For the rolling of open-hearth metal in the rail-structural plant there was a blooming mill with 90 mm diameter rolls driven by a steam engine of 3300 hp and a finishing train consisting of three stands with 710 mm diameter rolls driven by a steam engine of 4500 hp. Sections were rolled on mills 250, 350, and 400, driven by steam engines.

When the plant was constructed its further development was not envisaged; thus the selection of the site for a new open-hearth furnace plant in 1910 was very unfortunate, since the plant was so situated that it caused a disruption of the material flow between plants, and there was a considerable difference in the level of its floor compared with the blast furnace and rolling plants.

Technical equipment of the plant was at an extremely low level. The basic form of energy was low-pressure saturated steam generated by more than 200 very simple Lancashire and Cornwall boilers. Highest grade coal was used for boiler heating.

For the blast supply to the blast furnaces there were 18 vertical air-blowing steam engines of 400 – 600 hp operating with high steam consumption and without steam condensation.

Manual labor was predominant in the plants of the Yuzovka Works. No steps were taken towards easing the working condition and towards the mechanization of operations. The rollers, blast furnace operators, boiler attendants, coke oven, and puddling-furnace operators, welders and rolling-mill operators worked under unbearable conditions. The open-hearth furnaces were manually charged; hot metal was poured from the ladles moved on bogies by means of ground steam cranes.

There was a 13 hour working day. All payments to the workers were made through a store. Such a system made it easier for the employers to cheat and rob the workers and to make them insolvent debtors.

A badly planned workers settlement, with its open refuse bins and lavatories in the middle of the streets, was a constant source of epidemic. The first hospital, with two doctors, was organized only after the cholera epidemic in 1892. Up to 1902 there was only one school in the settlement.

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* Stalino– formerly Yuzovka.

SIGNIFICANT DATES

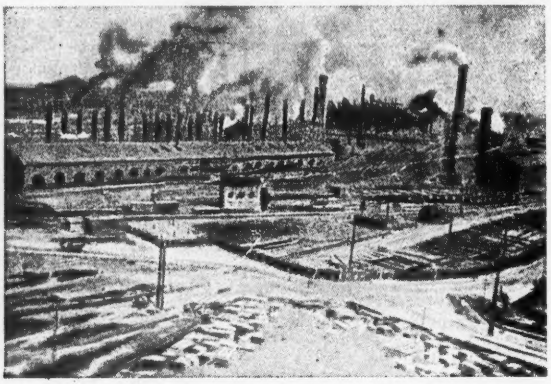
1953

JANUARY. The Baku tube-rolling works started production.

1954

JANUARY. At the Magnitogorsk Metallurgical Combine blast furnace No. 8 was put into operation. The equipment for electric arc heating of the hot top of the ingots was introduced at the "Electrostal" Works.

JULY. The first batch of pig iron was obtained from blast furnace No. 1 at the Zakavkaz Metallurgical.



General view of the Yuzovka Works prior to the Revolution.

Life and work under these miserable conditions of ruthless exploitation provoked the indignation of the workers and awakened their revolutionary consciousness.

In 1874, two years after the plant was put into operation,an organized protest against the payment method was made by the workers.

On the execution of the Petrograd workers on January 9, 1905, the Yuzovka workers came out on a political strike; the plant came to a complete standstill.

In spite of the repressions and police reprisals after the events of 1905, the Bolshevik revolutionaries who went underground did not give up their activities in Yuzovka. As early as 1907 the workers of Yuzovka bravely and openly signalled the first of May. Early that morning the workers and the inhabitants of the settlement saw a red flag which was waving atop the smoke-stack in the moring haze, inspiring workers with new hopes. The flag was hoisted by worker Pavel Zahoruiko.

In spite of the efforts of the police and the plant management, no man could be found who would take down the flag on that significant day. The red flag flew proudly over the plant until the end of the day.

Workers of the Yuzovka Metallurgical Works – I. Lohutenko, Ya. Zalmaev, F. Zaitsev and others – formed a revolutionary nucleus at the plant. They joined the Bolshevist Party, distributed Marxist literature, organized protests and strikes of workers, explained the revolutionary teachings, and stirred up the fight against the autocracy.

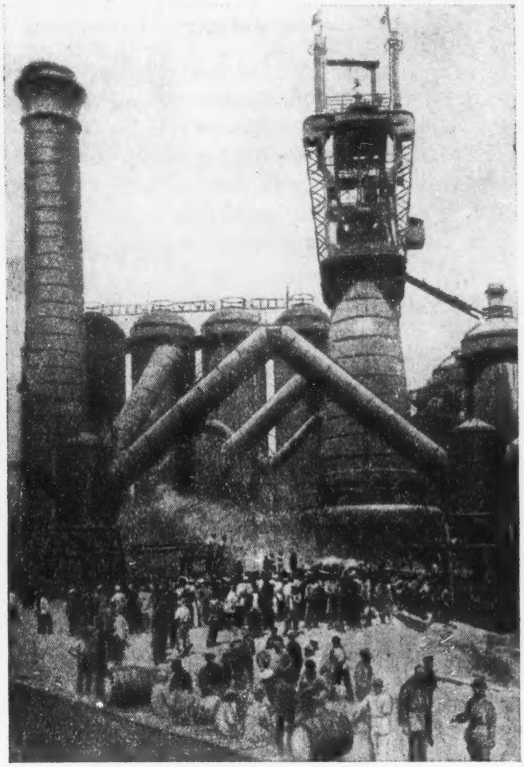
The high profits gained by the owners of th Yuzovka Works provided means for a further development. In 1910 the construction of the second open-hearth furnace plant on a new site began.

By 1913 there were five blast furnaces in the blast furnace plant, four of them considered the best designed in the south of the Ukraine. By 1916 in the new open-hearth furnace plant, three furnaces of 50-ton capacity

each were put into operation and provided with charging and pouring electric cranes. The electrification of the rolling mills began even earlier. The capacity of the power stations serving the plant was 8000 kw. By 1913 the steam engines of the section mills were gradually replaced by electric motors. However, on the main rolling operation manual labor was employed as before.

The output of the Yuzovka Works in 1913 was: pig iron – 277,00 tons, steel – 230,000 tons, rolled product – 183,000 tons, and coke – 437,000 tons.

In the years of the Civil War, many workers from Yuzovka fought in the ranks of the Red Army against the White Guard bands and the hordes of the interventionists. I. Ya. Kiselev, F.V. Starovoitov, P.A. Vasilchenko, M.T. Volosevich, and others distinguished themselves by their conduct.



Meeting of workers before starting blast furnace No. 1 of the Stalino Works (1924).

At the end of 1919, the administration of the Donbass region finally passed to the Soviets of Workers', Peasants', and Red Armymen's Deputies.

The Yuzovka Metallurgical Works found its true owner – its own workers. Regardless of the devastation and famine, and the actions of Wrangel's White Guard hordes who approached Yuzovka and disrupted work in the coal mines, the workers of Yuzovka turned all their efforts to a speedy reopening of the plant. By the middle of 1920 sufficient quantities of coke and raw materials were accumulated, and on June 6 the first blast furnace was blown in.

Soviet people under the leadership of the Communist Party restored war-damaged establishments under very difficult conditions.

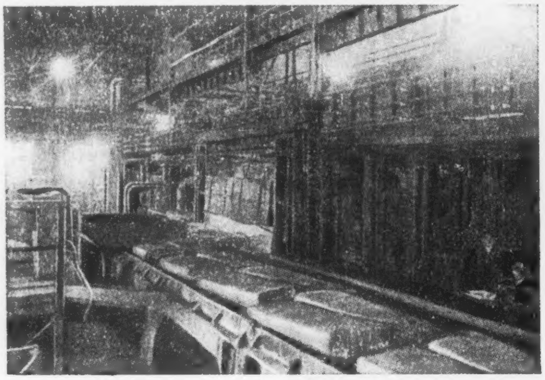
By 1929 the plant was fully restored and partly modernized; the technical personnel of the Stalino Metallurgical Works began to realize the Five-Year Plan regarding a further modernization of the plant. Its output in 1929 was (in % of the 1913 output): pig iron 108.6%, steel 103.6%, rolled product 105.5%, coke 121.4%.

As a result of the modernization carried out during the first Five-Year Plans, the plant reached the level of the best metallurgical plants in the country with regard to the scale of production, technical equipment, and the quality of the product.

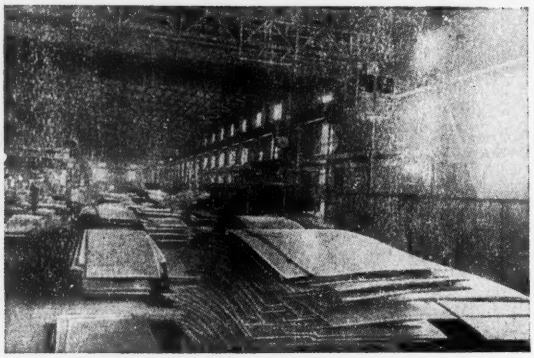
In order to eliminate heavy manual operations, the plant's employees proposed to erect a bunker scaffolding with ore crane and scale car without closing down the furnaces and lowering the output. The government approved this plan, which was carried out in 1933.

In place of the old air-blowing steam engines, a gas-and-air-blowing station was erected. The construction of two casting machines eliminated the heavy labor of pouring molten metal onto sand.

In 1940 the blast furnaces were modernized and the main labor-consuming processes were mechanized. The old open-hearth furnace plant, where all important operations had been performed manually, was pulled down and in its place a bunker scaffolding of the blast furnace plant was erected. In the new open-hearth furnace plant, which had four 75-ton capacity furnaces by the beginning of the first Five-Year Plan, four more open-hearth furnaces were built. At the same time extensive work was carried out to increase the crane capacities and the weight of furnace charge. By 1940 the open-hearth furnace plant had 8 120-ton capacity furnaces, heated by triple mixture (blast furnace, coke oven, and producer gases) and employing partial pouring on bogies.



New heating furnaces of the plate rolling mill.



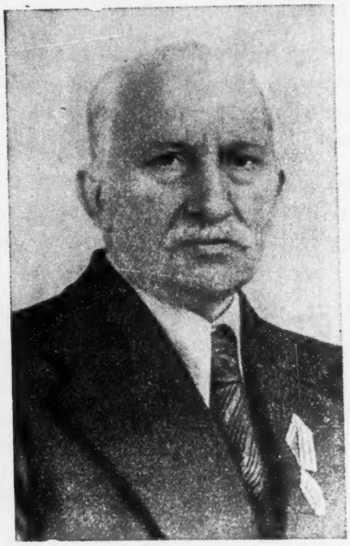
Stock of the final product of the plate rolling mill.

The skill and technical qualifications of the workers and the ITR* improved markedly; the plant successfully adopted the making of high-grade carbon steels and alloy steels of various grades.

The design of open-hearth furnaces was substantially modified: in place of earlier widely employed two-level port ends having Venturi ends with water-cooled ports water-cooled frames and covers of charging doors were installed, and pneumatic lifting of doors was introduced.

In the blooming plant the heating facilities were modernized: old soaking pits were modified and new ones built. The rolling of heavy ingots of big-end-up type with the hot top was mastered. The establishment of a large finishing department equipped with overhead electric cranes and the change-over from manual to pneumatic chipping of rolled material resulted in a considerable improvement of metal quality. Retarded-cooling pits were built in connection with the introduction of alloy steel production.

* Engineers.



K.G. Mogilevsky – former head of the plant's design bureaus, now retired.

V.D. Staroverov – worker employed at the plant for over 45 years, now retired.

New heating furnaces were built and equipment for metal finishing was introduced in the section mill.

As a result of its modernization the Stalino Works produces high-quality steels and supplies the following (among others) branches of industry with metals: motor and tractor, tube, machine building.

In 1940 the output of pig iron, steel, and rolled product increased by factors of 2.44, 2.23 and 2.02 respectively, compared with 1913.

For the workers and their families well-planned houses were built, as well as clinic, schools, clubs, a rest home at the seaside of Azov, kindergartens, and a bath and laundry establishment.

In October, 1941, when the fascist hordes reached Donbass, the plant was shut down, part of the equipment having been dismantled. Men and equipment were sent to the Urals. Many of the workers joined the armed forces and bravely defended our homeland.

A large number of blast furnace, open-hearth furnace and rolling mills operators, and other workers from the Stalino Works were employed at the Serov, Alapaev, Zlatoust, Nizhne-Tagil, Ashinsk and other Works.

After the town of Stalino was liberated from the German aggressors, a group of workers headed by the director, P.V. Andreev, returned to the plant to began its reconstruction.

Before retreating the Germans had wrecked the plant. The situation was still further aggravated by the absence of electric power.

However, as early as September a small power station of 50 kw-hr was put into operation.

The first of the units put into operation was open-hearth furnace No. 4 – started on February 14, 1944, and on March 14, blast furnace No. 2 was blown in: an old preserved, vertical, air-blowing steam engine being employed.

For its successful work on the reconstruction, the plant was on several occasions awarded the Red Banner

of the State Defense Committee; by the decision of the VTsSPS* and the Ministry of Ferrous Industry, this Banner was eventually given to the Stalino Metallurgical Works for keeping in perpetuity.

Many workers and ITR distinguished themselves in this difficult but worthy task. The following deserve special mention: experienced and class-conscious worker V.D. Staroverov who spent over 45 years at the plant; foreman on furnace building — A. T. Solomko; Head of the Design Bureau — K.G. Mogilevsky, who saved the plant's archives of drawings and designs under difficult conditions.

The reconstruction of the plant was, in the main, completed in 1951. During that period and during the subsequent years the modification of units and modernization of equipment was, and still is being, carried out; special attention is paid to the mechanization of labor-consuming operations and the automation of technological processes.

In December, 1956, a large new blast furnace No. 1 with 1033 cu m working volume, replacing the old one of 535 cu m volume, was blown in.

The furnace has an all-welded shell. The upper part of the well and the bottom part of the hearth are lined with carbon blocks. The hearth of the furnace is equipped with an electric gun of the latest design of the IZTM** type, with 0.5 cu m cylinder volume; there is a Kostin pneumatic hammer and a drilling machine for opening the tap hole and a mechanized stopper at the slag notch. The furnace operates at an increased gas pressure. An overhead crane of 20/5 tons lifting capacity with a grab bucket and a magnet is installed for operations at the hearth and in the casting bay. The dust-catchers are provided with screw conveyers with remote control for the removal of the humidified furnace dust.

Automatic control on the furnace includes: charging system, gas pressure in the space under the cone, the temperature of the hot blast, the temperature of the checker top and the roofs of the air-heating stoves, gas combustion in the stoves, and the pressure of clean gas. The furnace is provided with the latest equipment, allowing a maximum mechanization of labor-consuming operations.

This year blast furnace No. 2, of 450 cu m working volume, is being replaced by a new, considerably larger one.

The furnace will be operated at an increased top gas pressure and therefore a second, large turbine air blower — of 3250 cu m per min capacity at 3.8 atm pressure — has been installed. For the first time in world practice, this furnace will be provided with the evaporative cooling which will result in an increased durability of the coolers, the consumption of cooling water for various elements of the furnace being considerably reduced at the same time.

The new stoves are fitted with powerful burners which ensure the heating of the blast to 900°C.

Blast furnace No. 3, of 627 cu. m, was blown in in 1933. In 1948 during the major overhaul of the furnace a modern casting bay, equipped with an overhead crane was constructed and the distribution of the transport lines was improved. In 1956 blast furnace No. 3 was pulled down and in its place a new, large volume furnace is being erected.

Blast furnace No. 4 was reconstructed after the war in April, 1950, and it is still in operation. It is the smallest of the furnaces at the plant: its volume is 600 cu m. It processes blast furnace ferrosilicon. A major overhaul of the furnace and an enlargement of its working volume is planned for 1959 — 1960. The furnace will be specially equipped for the processing of ferrosilicon. The plan envisages the installation of cooling segments, a cooled cup of the large bell, plate fin coolers of a new type, cooled stock indicators etc. The ferrosilicon will be smelted with use of oxygen-enriched blast.

When the prospects of an increase in pig iron output at the Stalino Works are considered, mention should be made of such potential factors as the replacement of raw ore with sinter and the change-over to the production of low-manganese conversion pig iron.

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* All-Union Central Council of Trade Unions.

** Transliteration of Russian — Publisher's note.

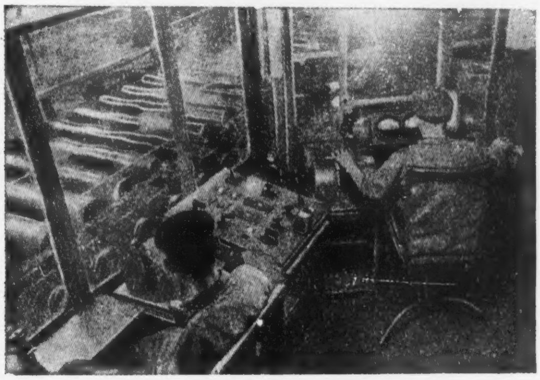
N.G. Bychkov – best steel worker of the open-hearth furnace plant.

T.I. Gapon – foreman of blast furnace No. 1.

With the starting of open-hearth furnace No. 8 in 1951, the open-hearth plant was fully re-established. All open-hearth furnaces were fitted out with magnesite-chromite roofs during the time of reconstruction and in the course of the post-war Five-Year Plans.

The open-hearth furnaces of the Stalino Works have an evaporation cooling system, which previously was not used anywhere in the world. All furnaces have automatic equipment for valve changing and for thermal condition control.

Four furnaces have waste-heat boilers. The crane equipment has been enlarged. A new charge yard and a building for the preparation of molds for casting have been constructed. All these measures and other minor improvements will allow, even this year, a considerable increase in steel output.



Control panel of the four-high stand of the plate-rolling mill.

The most labor-consuming and exhausting work in the open-hearth furnace plant was always the pourers' work on the preparation of the mold for steel casting. It is planned to install in the casting bay of the plant a continuous steel casting equipment, which will result in an increase of good quality product; cast slabs for the plate-rolling mill will be obtained and the heavy work of the pourers will be eliminated. The equipment is of a vertical type, placed underground; it is designed for simultaneous pouring of a heat through four crystallizers from a ladle of 140 ton capacity.

Owing to the intensification of the steelmaking process with oxygen, the metal requirements of the rolling mills will be met in the next few years.

In the post-war years, section wills 250 and 400 were reconstructed. The driving means of the mills were enlarged and modernized, and modern heating furnaces with automation control of thermal conditions were built. New coolers and cutting and removal equipment were also installed; new buildings were built for these mills; and a new two-floor finishing shop, equipped with overhead electric cranes and means for dressing and straightening of product, was established.

Section mill 350 and the blooming mill were not radically modified, but here also several important improvements in the design of individual mechanical units and in the mechanization of labor-consuming processes were made.

In 1953 a new medium plate mill 2300 of modern design was put into operation; it consisted of two stands: a three-high roughing and a four-high finishing stand, several additional machines, and auxiliary equipment. Auxiliary plants were also subjected to thorough modernization.

The personnel of the Stalino Metallurgical Works are proud of the glorious history of their plant. In the near future the Stalino Metallurgical Works will become an even larger and more advanced metallurgical concern.

F. N. Grigorev
Head of the Technical Department

SIGNIFICANT DATES

1955

MARCH.	Furnace No. 1 of the Orsk-Khalilovsk Combine was added to the existing operating furnaces.
APRIL.	Furnace No. 2 at the Zakavkaz Metallurgical Works was put into operation.
	A new rolling mill 300 was put into operation at the Chelyabinsk Metallurgical Works.
MAY.	The first plant in the USSR for continuous steel casting was installed at the "Krasnoe Sormovo" Works.
JULY.	The plenary meeting of the TsK KPSS (Central Committee of the Communist Party of the Soviet Union) passed a resolution on "Tasks on further development of industry, technical progress and improvement of the organization of production."
AUGUST.	The first batch of pig iron was obtained from blast furnace No. 1 at the Cherepovets Metallurgical Works.
NOVEMBER.	A large sheet-rolling mill 2800 was put into operation at the Voroshilov Works.
	Industrial use of oxygen for blowing through the open-hearth furnace bath by means of furnace roof equipment was begin at the "Zaporozhstal" Works
DECEMBER.	A large-capacity blast furnace No. 4 was blown in at the Chelyabinsk Metallurgical Works.

"RED OCTOBER"

Sixty years ago in the fall of 1897 in Tsaritsyn on the Volga, an iron and steel plant built by French capitalists began to operate. Thanks to a favorable situation (at the junction of a gigantic waterway and a railroad connecting Tsaritsyn with southern and central Russia) and the presence of cheap labor in the land along the Volga , the plant developed rapidly.

When the plant first went into operation, there were two 5-ton and four 20 – 30 ton open hearth furnaces. Ingots were sent to the rolling mills, including blooming mills, rail mill, medium and light section mills and rod mill. In addition, there was at the plant a plate mill with universal and thin sheet trains and an eight-stand train for rolling roofing tin.

Mechanization of the processes was almost non-existent. Furnaces were hand charged and charging materials were loaded and brought up to the furnaces by hand. Similar conditions existed in the rolling mills. Only the basic units of the plant – the blooming mill and section mills – were steam driven; steel was poured by steam driven machinery and steam cranes collected and distributed pouring assemblies and runners.

The plant workers lived in the so-called "Russian village" in barracks and clay hovels. The highly paid French experts and engineers, however, occupied luxurious private residences with gardens in the "Little France" and "Great France" settlements.

Severe labor conditions and low pay caused protests by the workers and strikes. One of the first strikes was that of the plate mill operatives which broke out on the 7th April, 1901 because of a reduction in pay. Workers from other shops joined the strikers; clashes with the police occurred. The workers demanded higher pay, better living conditions and a cessation of the rough treatment, especially by the French. Dozens of workers were arrested and hundreds dismissed.

To aid the gendarmery, an infantry regiment was dispatched to be permanently stationed in the town of Tsaritsyn. The revolutionary movement at the plant, however, took on a wider aspect. Underground groups made their appearance and a committee of underground workers was formed by the workers Gavrilov, Petrov and Podchassov.

After "Bloody Sunday", 9th January, 1905, the plant workers, roused to anger by the arbitrary action of of the Tsarist authorities, organized meetings and strikes.

In 1912, the plant was converted into the "Donets-Yurevsk Metallurgical Company" (DYuMO) and in 1913, it reached the maximum level of production: 120,000 tons of steel and 100,000 tons of rolled products were produced. There were then 4,000 people working at the plant. The plant produced roofing tin, hoop iron, galvanized iron, railroad fish plates, sole plates, wire rods and rolled products for bolts and shovels.

On the 22nd November, 1918, the DYuMO plant was nationalized by decree of the VSNKh.

When the young Soviet Republic was assailed on all sides by enemies, the workers at the plant, on the instructions of the Revolutionary War Council, organized the repair of armored trains and manufactured armor plate, armored cars and other military equipment for the army. In 1919, when the front was approaching the town, the workers took up arms and defended Soviet power.

INTERESTING DATES

1956.

JANUARY.	The first number of the technical periodical "Metallurgist" was issued.
FEBRUARY.	Opening of the 20th Session of the Communist Party of the Soviet Union.
MARCH.	The first 500-ton open hearth furnace in the U.S.S.R went into production at the Voroshilov Plant. At the Kuznetsk iron and steel combine, the first automatically operated scale car in the Soviet Union was commissioned.
JUNE.	The Nizhne Tagil iron and steel combine was the first to produce pig iron with oxygen-enriched blast.
AUGUST.	At the Dzerzhinsk plant, the powerful blast furnace No. 12, built in the record time of six months, produced its first iron.
SEPTEMBER.	The second 500-ton open hearth furnace was built at the Voroshilov plant.
NOVEMBER.	The powerful tube mill at the Dzerzhinsk plant produced its first tubes.
DECEMBER.	40-ton converters went into operation at the Orsk-Khalilovo combine.

The military hand over the Red October plant to the management. (Photo: G. Samsonov).

During the years of civil war, the plant was, to a large extent, destroyed. The 5-ton open hearth furnaces were the first to be restored and utilized, followed by the blooming mill and soaking pits. Next followed the auxiliary shops, mechanical workshop, forge, etc.

In December, 1922, the plant was renamed "Red October". In 1925, its productive capacity attained the prewar level. Arming itself with the latest techniques, the plant constantly raised its production of steel and rolled products.

During the first Five-Year Plan, the construction of a large tractor plant was begun; in this connection, the VSNKh presidium decided, in September, 1929, to turn over the Red October plant to the production of high grade metal. Operating at first with small, and later with large, open hearth furnaces, the plant metallurgists began to master the production of high grade steel.

The first 5,000 tons of alloy steel were to be produced in May-October, 1930. At the end of the year, the plant produced 7,500 tons of alloy and high alloy steels. It became one of the largest suppliers of high grade metal. At that time, the Red October plant was the first in the U.S.S.R. to use bottom pouring.

Awarding of the Red Banner of the Council of Ministers of the U.S.S.R. and VTsSPS to the plant. (Photo: G. Samsonov).

The government released considerable capital for the reconstruction of the plant: in 1930, the blooming mill was completely electrified and mechanized; in 1931, a plant for the production of close tolerance sections was put down; in 1932, the construction of a new, mechanized medium section mill was completed, being one of the largest in the country. In the same year, by order of the People's Commissariat for Heavy Industry, the plant came under the control of "Glavspetsstal" (Special Steels Board).

In 1934, a shop was built for the production of cold rolled automobile sheet and a new open hearth plant was put into commission with several large furnaces and high capacity charging and pouring cranes.

At the end of the first Five-Year Plan, the productivity of the plant increased more than threefold compared with 1913. There was a tenfold increase in electric generator capacity. Electric crane capacity increased twelvefold. Most of the processes involving heavy labor were mechanized.

In 1935, a large group of workers, technicians and office staff at the plant were decorated with orders for the success achieved; in 1939, the plant received the Order of Lenin.

The year 1941, eve of World War II, was one of maximum productivity; the plant produced 774,400 tons of steel and 525,300 tons of rolled products.

The growth of the plant was accompanied by an increase in the size of the workers' settlement. Two – to four-story apartment blocks replaced the hovels. Total area given over for dwelling space was more than 250,000 sq m. The settlement had gardens and was well organized.

From the early days of the second world war, the plant began to work on defense. The production of high grade alloy steels for arms and military supplies was organized. The communist steelworkers Ponomarev, Podbereznikov, the Sokolovs (farther and son) and many others distinguished themselves by their hard and unselfish work.

In the summer of 1942, the fascist hordes were approaching Stalingrad. Without lowering the tempo of production, the workers strengthened the city's defenses – they dug trenches, anti-tank ditches and built pillboxes.

On the 23rd August, the city underwent severe bombardment. On the following day, the plant ceased work and, on the 25th August, the evacuation of workers and their families across the Volga began.

A combat batallion formed at the plant, with the plate mill worker K.P. Pozdnyshev in command, occupied a line of defense beyond the tractor plant in the region of the Hitlerite breakthrough.

In its ranks was Olga Kuzminichna Kovaleva, a famous steelworker in the open hearth shop, a deputy of the city council who died bravely in the first battle. This valiant patriotic woman was posthumously awarded

Old school in the plant settlement.

New school for children of the iron and steel workers.

the highest decoration for courage and bravery – the Order of Lenin. Pozdnyshev, the battallion commander, also perished in this battle. Until the approach of sections of the Soviet army, the fighters of this batallion manfully beat off the attacks of their opponents. From October, 1942, fighting took place in the plant itself. After three months of bitter fighting, during the night of the 10th of January, 1943, our troops completely cleared the remnants of the Hitlerites from the plant.

On the 3rd of February, 1943, the second day after the groups of Germans surrounding Stalingrad had been destroyed, workers cadres began to return to the plant and slowly set about restoring the works.

There was much to be done. The looters had destroyed and damaged almost all the open hearth furnaces and rolling mills. Thanks, however, to the unselfish labor of the iron and steel workers, the first heat was produced from the first rebuilt open hearth furnace on the 31st of July, 1943.

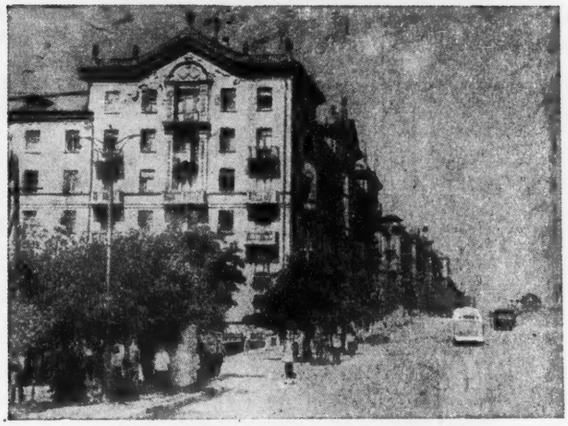
On the 26th of March, 1944, the blooming mill was started up. Other shops followed it.

In 1948, after the government had successfully completed its task of restoring the plant and, in connection with the plant's fiftieth birthday, by order of the Presidium of the U.S.S.R. Supreme Soviet, the Red October plant was awarded the Order of the Red Banner of Labor.

The introduction of new techniques and of the foremost technological advances and the growing technical experience of the groups of workers brought about a marked increase in the production of high grade steels in the fifth Five-Year Plan.

In the melting shops, all the open hearth furnaces were equipped with magnesite-chrome roofs and forsterite checkers, the number of magnet cranes for handling charging boxes in the stockyard was greatly increased as were the number and capacity of the charging machines in the open hearth shops. A number of small capacity pouring cranes was replaced by more powerful ones of 200 tons capacity and the capacity of some old pouring bay cranes was increased. Nearly all the open hearth furnaces were rebuilt, their charging and thermal capacities were raised and the system of automatic control and instrumentation was perfected.

In open hearth shop No. 1, steel is bogie cast, fettling is mechanized, all large furnaces are equipped with hot cooling. Steel melting and pouring techniques have undergone substantial development; oxygen is widely used for the production of high alloy steel in electric furnaces.



Apartment blocks belonging to the plant.

Much has been done also in the rolling mills: flame deseaming has been introduced for dressing billets and slabs for the section and plate mills; all reheating furnaces have been fully equipped with instruments; many furnaces are automatically controlled, recuperators have been installed, steel rolls are surface hardened and are hard faced. Ingot weight for the blooming mill has been increased and improved conditions for reheating and rolling have been applied. The stands have been equipped with roller guides. Some parts of the rolling mills are mechanized and organization of repairs of basic mill equipment has been improved, etc.

Last year, the plant increased steel output by 103,000 tons and the output of rolled products by 61,000 tons compared with 1955. In the first quarter of this year, the plant collective won first place in the All-Union socialist competition and was awarded the Red Banner of the U.S.S.R. Council of Ministers and VTsSPS.

At the same time as the restoration of the plant, there began the building of the settlement which had been completely destroyed by the troops of occupation. In the postwar period, 169,000 sq m of dwelling space has been built. In addition, the plant has greatly helped the workers in the building of individual houses.

For the workers' children, ten schools containing 5,360 places, seven kindergartens with 550 places and five creches with 442 places have been built. There has also been built a hospital, a polyclinic, a maternity home, a drug store, a tubercular prophylactory, a House of Technology and a Palace of Culture is in the course of construction.

On the ground floor of the multi-story apartment blocks, there are stores, a cafe, dining rooms, hairdressers,etc. The entire settlement is laid out with gardens.

By the end of the sixth Five-Year Plan, it is planned to provide an additional 65,000 sq m of dwelling space, to build a metallurgical technical school, a hospital with 200 beds, a school with 960 places and several kindergartens and creches.

The reactivation of the plant was accompanied by a continuous growth of the cadres of workers, engineers and technicians. Simultaneously with the return of workers to the plant after the war, young people with passes from the Central Committee of the VLKSM* have converged on Stalingrad from all parts of the country. Apprentices are tought the steelmaking and rolling trades. Seventy-five percent of the new workers took the places of the old groups who had gone off to the front or who had been evacuated to the East. Many of them went through the plant school for apprentices, the trade schools, the foremen's courses and soon became qualified steelworkers, rollers and welders.

Now, side by side with the highly skilled workers, steelmaker V. Ya. Novodechinsky, open hearth shop No. 2 first hand D.G. Trubnikov, Senior roller of the 750 train A.I. Kussmartsev, senior hands in the open hearth

* All-Union Lenin's Young Communist League.

shops F.G. Ponomarev and M.V. Nagornov and others who have worked at the plant for more than thirty years, there are working the foremost young people in production: open hearth workers Deputy of the Supreme Council of the RSFSR Anatoly Serkov, Dmitry Trubnikov, Viktor Yakovlev, Vladimir Ignatov, Eugene Chekin, Boris Grinko, Dmitry Milovanov, the senior roller of the 450 – 2 mill Anatoly Arkov, roller of the 450 – 1 mill Pyotr Fasstok, open hearth first hands N.V. Sedelnikov, P.Ya. Tushkanov, N.D. Skrinnikov and others.

In 1957, more than 200 measures are to be put into effect to raise productivity, including the building of a more highly developed machine for the semi-continuous casting of steel and a vacuum treatment plant.

INTERESTING DATES

1957

APRIL.	At the Azovstal plant, the large new tilting furnace No. 12 went into operation.
JUNE.	The large new blast furnace No. 5 was blown in at the Makeyevka iron and steel plant.
AUGUST.	Saw the beginning of the development, on an industrial scale, of the largest iron ore deposits in Europe at the Sokolovsko-Sarbai ore concentration combine.
	The new open hearth furnace No. 11 was put into commission at the Zaporozhstal plant.

Steelworker D. Trubnikov.

Steelworker A. Serkov.

During the sixth Five-Year Plan, the government has decided on a radical reconstruction of the plant – the 130-ton open hearth furnaces will be put on natural gas firing and a large electric melting shop and oxygen plant will be built.

Continuous casting machines will be installed in the open hearth shop. The rebuilding of the open hearth furnaces and the construction of a new steel melting shop will enable the output of alloy and highly alloyed steels to be substantially increased.

The blooming mill will be modernized and equipped with the latest type of recuperative soaking pits.

Senior rolling mill worker I. Mokryakov.

A special machine will be installed for the flame deseaming of blooms immediately after rolling. A number of old, non-mechanized mills are marked down for dismantling, and will be replaced by new, more productive, mechanized and automated section and sheet mills.

When all the above-mentioned measures have been effected, there will be a marked increase in the production of steel and rolled products.

N.S. Dvchenko
(Head of Technical Department)

A NEW METALLURGICAL BASE

Prior to the revolution, Kazakhstan was a neglected borderland of Russia, whose enormous resources of raw materials and mineral wealth were not utilized at all.

Soviet power has vitalized this desert and rich country and now Kazakhstan has become one of the most important industrial republics of the Soviet Union, taking third place (after the RSFSR and the Ukraine) in the country for overall industrial output and consumption of ferrous metals.

The leading part in the general development of heavy industry is played by the iron and steel industry.

In 1927 – 1928, Kazakhstan consumed 20,600 tons of metal, in 1938 consumption was already 89,300 tons while, in 1956, it was almost eleven times higher than in 1940.

The growth of industrial and railroad construction meant that Kazakhstan, like other formerly backward national republics (Uzbekistan, Georgia, Azerbaijan), needed its own metallurgical industry.

Kazakhstan holds first place in the U.S.S.R. as regards iron ore reserves.

Powerful industrial undertakings have been created in the Kazakh Republic on the basis of these resources: the Aktyubinsk ferroalloy plant, the Kazakh iron and steel plant in the town of Temir Tau, the Don chromite mines, the Dzhezdin manganese mines and the Kozyrev and Atassui iron ore mines. The Karagandin iron and steel plant and the Sokolovsko-Sarbai ore concentration combine are being built.

Ferrous metallurgy arose in Kazakhstan in the third Five-Year Plan when, in 1938, the Don Chromite mines were put into operation.

In 1942, during the second world war, the Aktyubinsk ferroalloy plant was the pioneer of "quality metallurgy" in Kazakhstan and the largest ferrochromium plant in the U.S.S.R. and Europe. It uses ores from the Don deposits.

The discovery and development of these large deposits in the Aktyubinsk region was of great practical importance in ensuring the supply of chrome ores for the Soviet Union's plants. This enabled the importing of Turkish chromite to be stopped even before the war.

The Don mines played an exclusively important role during World War II in guaranteeing the supply of high grade ore to the ferroalloy plants.

At the present time, the Don mines play an exceedingly important part in the country as a whole as regards the winning of chrome ore.

From year to year, the Aktyubinsk plant is extending its range of products and is improving their quality. The ferroalloys from this plant are consumed in the production of high grade tool steels, free-cutting steels, magnetic, heat-resisting, acid-resisting and other steels.

The fifth Five-Year Plan was fulfilled by the plant earlier than planned. In 1955, the production of ferroalloys was almost doubled and overall production was 2.3 times as high as the 1950 level. The productivity of labor increased 2.1 times, production costs were lowered by 36% and the overall consumption of electricity was 1.5 times greater during this period.

In the sixth Five-Year Plan, the importance of the Aktyubinsk Ferroalloy plant is increasing still more.

By increasing productive capacity, the rise in labor productivity and the modernization of existing production equipment will be more than doubled and production costs will be substantially reduced.

During the second world war, a manganese industry developed in Kazakhstan. The Dzhezdin manganese mines were commissioned in 1942 and became the main supplier of high grade manganese ore for the Magnitogorsk iron and steel plant. The mine is now one of the chief manganese bases in the eastern part of the country. It will indeed serve as a raw materials base for a new ferroalloy plant.

In December, 1944, the first open hearth furnace of the Kazakh steel plant was started up in the town of Temir Tau. The second furnace went on in September, 1947 and the third in February, 1949. This completed the construction of the open hearth plant. In June, 1946, the first medium section mill of the Kazakh steel plant began rolling. The second mill – a sheet mill – was commissioned in November, 1947 and the third – a light section mill – in December, 1950.

There are at present in operation at the Kazakh steel plant, three open hearth furnaces and three mills.

The fifth Five-Year Plan was fulfilled by the plant in less than four years. The plant is now producing twice as much steel and almost three times the tonnage of rolled products as was envisaged according to the plan and an increase in production has been attained without the addition of new units.

In the past year, more than 10% of Kazakhstan's national economic requirements of rolled steel products was satisfied by the Republic's own plants.

The enormous increase in planned steel melting capacity and the production of rolled products at the Kazakh plant is, to a large extent, due to the application of the leading techniques and technology, progressive organization of production and wide dissemination of the experience of development engineers. The amount of steel produced per sq m of hearth area in open hearth furnaces at the Kazakh plant in 1956 was 7.64 tons, i.e., it attained the level reached by the foremost iron and steel plants in the country.

Production costs at the Kazakh plant are much lower than those of many other similar plants and even lower than those of the largest integrated plants. Taking the cost per ton of open hearth steel at the Kazakh plant as 100%, the cost at the Uzbek plant is 102%, at the Petrovsk-Zabaikalsk plant 105%, at the Verkhne-Saldinsk plant 126% and at the Amurstal plant 122%.

Among the leading steel men at the plant are many kazakhs who have mastered the most complex trades – melting, rolling, etc. The foremost Kazakh steel melter is Communist Party member Altynbek Daribayev who is known not only in Kazakhstan but also beyond the limits of the Republic. He is now Deputy Plant Manager of the Kazakh steel plant.

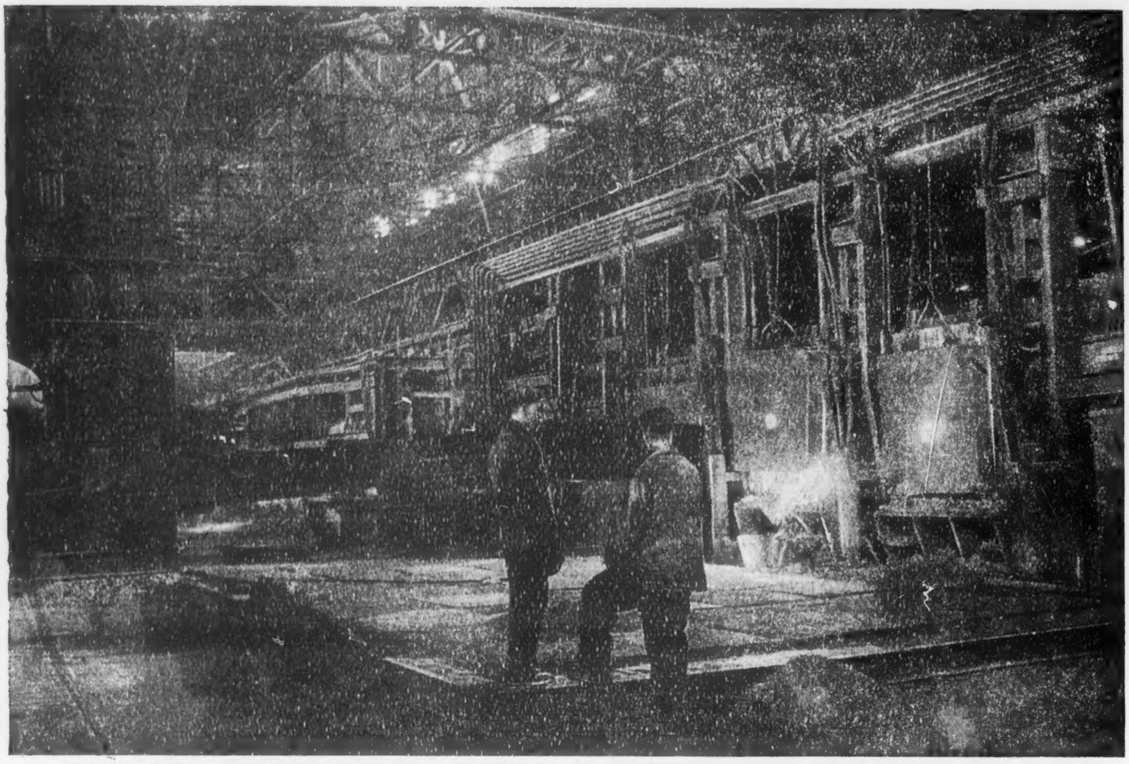
Universally known is the leading steel man of the Republic, melting shop brigadier of the Aktyubinsk ferroalloy plant, Deputy of the Supreme Council of the Kazakh Soviet Socialist Republic, Ismagul Ukibayev. Also successful in their production efforts were Tanabai Karimov, Vassily Koptyelov, Tulenbergen Nurbekov, Bakhtizhan Sembin and many others.

At the Twentieth Session of the Communist Party, the task was put forward of creating the Siberia and Kazakhstan, during the next tow or three Five-Year Plans, a third new powerful metallurgical base with a production of fifteen to twenty million tons of iron per year.

In the near future, the Karagandin, Kustenai and Pavlodar regions of the Republic must become the ore base for the iron and steel industries of the Urals, Western Siberia and Kazakhstan.

Nearly all Kazakhstan's iron ore deposits lie close to the surface and consequently the ore can be won by the most effective method – that of open cast mining. In addition, all the iron ore deposits are located relatively near to the railroads. Thus, great capital outlay for transportation of ore will not be required.

Nevertheless, the iron ore industry in Kazakhstan began to develop only in the fifth Five-Year Plan when the Kozyrev mine was opened to supply many of the East's metallurgical plants with high grade open hearth ore.



Open hearth shop of the Kazakh steel plant.

With the development of the Sokolovsk, Sarbai and Karadzhal mines, the problem of supplying the Urals plants with ore will be solved.

During the sixth Five-Year Plan, the Atassui iron ore mines are also being constructed in the Karagandin region. These mines will be the main raw materials base for the Karagandin metallurgical plant – the most important ferrous metallurgical undertaking in Kazakhstan being built in the sixth Five-Year Plan as an integrated plant. The plant will play a great part in the complex development of the national economy of the eastern regions, especially of Kazakhstan. The favorable geological conditions associated with the occurence of the Atassui ores coincidental with the large deposits of coking coal in the Karagandin Basin will make it possible to obtain cheap high grade ore and coke and consequently low cost pig iron, steel and rolled products.

The production capacity of the new plant will exceed that of the Kuznetsk combine and, as regards technical equipment, it will be superior to all other plants in the Soviet Union, including Magnitogorsk. At the "Kazakhstan Magnitogorsk", all the production processes from ore preparation to the production of rolled products, will be completely mechanized and automated.

The effective volume of the blast furnaces at the plant is 1513 cu m. The largest open hearth furnaces and slabbing mill in the Soviet Union will also be put down at this plant.

Kazakhstan has enormous raw material sources of alloying elements for the production of high alloy steel. Based on these deposits, it is planned to build a ferroalloys plant at Pavlodar during the sixth Five-Year Plan to produce ferrochromium, ferrosilicon, ferromolybdenum, ferromanganese and other ferroalloys. The Pavlodar ferroalloys plant will be one of the largest in the country.

The ferrous metallurgical workers of Kazakhstan, like all the workers of the Soviet Union, are activating new reserves of production for the early fulfillment of the tasks set up for the sixth Five-Year Plan for developing the national economy of the U.S.S.R.

M. Daryshev, scientific worker of the Kazakh S.S.R. Academy of Sciences

METALLURGIST IN ENGLISH TRANSLATION

November, 1957

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